MITSUBISHI ELECTRIC

700 series

INVERTER FR-A701 INSTRUCTION MANUAL (BASIC)

FR-A721-5.5K to 55K
FR-A741-5.5K to 55K

Thank you for choosing this Mitsubishi Inverter.
This Instruction Manual is intended for users who "just want to run the inverter".
If you are going to utilize functions and performance, refer to *the FR-A701 Series Instruction Manual (Applied)* [IB-0600337ENG]. The *Instruction Manual (Applied)* is separately available from where you purchased the inverter or your Mitsubishi sales representative.

CONTENTS

A701

This Instruction Manual (Basic) provides handling information and precautions for use of the equipment.
Please forward this Instruction Manual (Basic) to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect the inverter until you have read through the Instruction Manual and appended documents carefully and can use the equipment correctly. Do not use this product until you have a full knowledge of the equipment, safety information and instructions.
In this Instruction Manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠WARNING **Incorrect handling may cause hazardous conditions, resulting in death or severe injury.**

⚠CAUTION **Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.**

The ⚠CAUTION level may even lead to a serious consequence according to conditions. Both instruction levels must be followed because these are important to personal safety.

1. Electric Shock Prevention

⚠WARNING

- **While power is ON or when the inverter is running, do not open the front cover. Otherwise you may get an electric shock.**
- **Do not run the inverter with the front cover or wiring cover removed. Otherwise you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.**
- **Even if power is OFF, do not remove the front cover except for wiring or periodic inspection. You may accidentally touch the charged inverter circuits and get an electric shock.**
- **Before wiring or inspection, power must be switched OFF. To confirm that, LED indication of the operation panel must be checked. (It must be OFF.) Any person who is involved in wiring or inspection shall wait for at least 10 minutes after the power supply has been switched OFF and check that there are no residual voltage using a tester or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.**
- **This inverter must be earthed (grounded). Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, IEC 536 class 1 and other applicable standards).**
  A neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard must be used.
- **Any person who is involved in wiring or inspection of this equipment shall be fully competent to do the work.**
- **The inverter must be installed before wiring. Otherwise you may get an electric shock or be injured.**
- **Setting dial and key operations must be performed with dry hands to prevent an electric shock.**
- **Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise you may get an electric shock.**
- **Do not change the cooling fan while power is ON. It is dangerous to change the cooling fan while power is ON.**
- **Do not touch the printed circuit board or handle the cables with wet hands. Otherwise you may get an electric shock.**
- **When measuring the main circuit capacitor capacity, the DC voltage is applied to the motor for 1s at powering OFF. Never touch the motor terminal, etc. right after powering OFF to prevent an electric shock.**

2. Fire Prevention

⚠CAUTION

- **Inverter must be installed on a nonflammable wall without holes (so that nobody touches the inverter heatsink on the rear side, etc.). Mounting it to or near flammable material can cause a fire.**
- **If the inverter has become faulty, the inverter power must be switched OFF. A continuous flow of large current could cause a fire.**

3.Injury Prevention

⚠CAUTION

- **The voltage applied to each terminal must be the ones specified in the Instruction Manual. Otherwise burst, damage, etc. may occur.**
- **The cables must be connected to the correct terminals. Otherwise burst, damage, etc. may occur.**
- **Polarity must be correct. Otherwise burst, damage, etc. may occur.**
- **While power is ON or for some time after power-OFF, do not touch the inverter as they will be extremely hot. Doing so can cause burns.**

4. Additional Instructions

Also the following points must be noted to prevent an accidental failure, injury, electric shock, etc.

(1) Transportation and Mounting

⚠CAUTION

- **The product must be transported in correct method that corresponds to the weight. Failure to do so may lead to injuries.**
- **Do not stack the boxes containing inverters higher than the number recommended.**
- **The product must be installed to the position where withstands the weight of the product according to the information in the Instruction Manual.**
- **Do not install or operate the inverter if it is damaged or has parts missing.**
- **When carrying the inverter, do not hold it by the front cover or setting dial; it may fall off or fail.**
- **Do not stand or rest heavy objects on the product.**
- **The inverter mounting orientation must be correct.**
- **Foreign conductive objects must be prevented from entering the inverter. That includes screws and metal fragments or other flammable substance such as oil.**
- **As the inverter is a precision instrument, do not drop or subject it to impact.**
- **The inverter must be used under the following environment. Otherwise the inverter may be damaged.**

Environment	Surrounding air temperature	-10°C to +50°C (non-freezing)
	Ambient humidity	90%RH or less (non-condensing)
	Storage temperature	-20°C to +65°C *1
	Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)
	Altitude/ vibration	Maximum 1,000m above sea level for standard operation. 5.9m/s^2 or less at 10 to 55Hz (directions of X, Y, Z axes)

*1 Temperature applicable for a short time, e.g. in transit.

(2) Wiring

⚠CAUTION

- **Do not install a power factor correction capacitor or surge suppressor/capacitor type filter on the inverter output side. These devices on the inverter output side may be overheated or burn out.**
- **The connection orientation of the output cables U, V, W to the motor affects the rotation direction of the motor.**

(3) Trial run

⚠CAUTION

- **Before starting operation, each parameter must be confirmed and adjusted. A failure to do so may cause some machines to make unexpected motions.**

(4) Usage

⚠WARNING

- **Any person must stay away from the equipment when the retry function is set as it will restart suddenly after trip.**
- **Since pressing STOP RESET key may not stop output depending on the function setting status, separate circuit and switch that make an emergency stop (power OFF, mechanical brake operation for emergency stop, etc.) must be provided.**
- **OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting inverter alarm with the start signal ON restarts the motor suddenly.**
- **The inverter must be used for three-phase induction motors. Connection of any other electrical equipment to the inverter output may damage the equipment.**
- **Performing pre-excitation (LX signal and X13 signal) under torque control (Real sensorless vector control) may start the motor running at a low speed even when the start command (STF or STR) is not input. The motor may also run at a low speed when the speed limit value = 0 with a start command input. It must be confirmed that the motor running will not cause any safety problem before performing pre-excitation.**
- **Do not modify the equipment.**
- **Do not perform parts removal which is not instructed in this manual. Doing so may lead to fault or damage of the product.**

⚠CAUTION

- **The electronic thermal relay function does not guarantee protection of the motor from overheating. It is recommended to install both an external thermal and PTC thermistor for overheat protection.**
- **Do not use a magnetic contactor on the inverter input for frequent starting/stopping of the inverter. Otherwise the life of the inverter decreases.**
- **The effect of electromagnetic interference must be reduced by using a noise filter or by other means. Otherwise nearby electronic equipment may be affected.**
- **When driving a 400V class motor by the inverter, the motor must be an insulation-enhanced motor or measures must be taken to suppress surge voltage. Surge voltage attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.**
- **When parameter clear or all parameter clear is performed, the required parameters must be set again before starting operations because all parameters return to the initial value.**
- **The inverter can be easily set for high-speed operation. Before changing its setting, the performances of the motor and machine must be fully examined.**
- **Stop status cannot be hold by the inverter's brake function. In addition to the inverter's brake function, a holding device must be installed to ensure safety.**
- **Before running an inverter which had been stored for a long period, inspection and test operation must be performed.**
- **For prevention of damage due to static electricity, nearby metal must be touched before touching this product to eliminate static electricity from your body.**

(5) Emergency stop

⚠CAUTION

- **A safety backup such as an emergency brake must be provided to prevent hazardous condition to the machine and equipment in case of inverter failure.**
- **When the breaker on the inverter input side trips, the wiring must be checked for fault (short circuit), and internal parts of the inverter for a damage, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.**
- **When any protective function is activated, appropriate corrective action must be taken, and the inverter must be reset before resuming operation.**

(6) Maintenance, inspection and parts replacement

⚠CAUTION

- **Do not carry out a megger (insulation resistance) test on the control circuit of the inverter. It will cause a failure.**

(7) Disposal

⚠CAUTION

- **The inverter must be treated as industrial waste.**

General instruction

Many of the diagrams and drawings in this Instruction Manual (Basic) show the inverter without a cover or partially open for explanation. Never operate the inverter in this manner. The cover must be always reinstalled and the instruction in this Instruction Manual (Basic) must be followed when operating the inverter.

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4 DRIVING THE MOTOR 47

<Abbreviations>
DU: Operation panel (FR-DU07)
PU: Operation panel (FR-DU07) and parameter unit (FR-PU04, FR-PU07)
Inverter: Mitsubishi inverter FR-A701 series
FR-A701: Mitsubishi inverter FR-A701 series
Pr.: Parameter Number (Number assigned to function)
PU operation: Operation using the PU (FR-DU07/FR-PU04/FR-PU07)
External operation: Operation using the control circuit signals
Combined operation: Combined operation using the PU (FR-DU07/FR-PU04/FR-PU07) and external operation
Standard motor: SF-JR
Constant-torque motor: SF-HRCA
Vector dedicated motor: SF-V5RU

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REMARKS

· For differences and compatibility between the FR-A701 series and FR-A700 series, *refer to page 196*.

1 OUTLINE

1.1 Product checking and parts identification

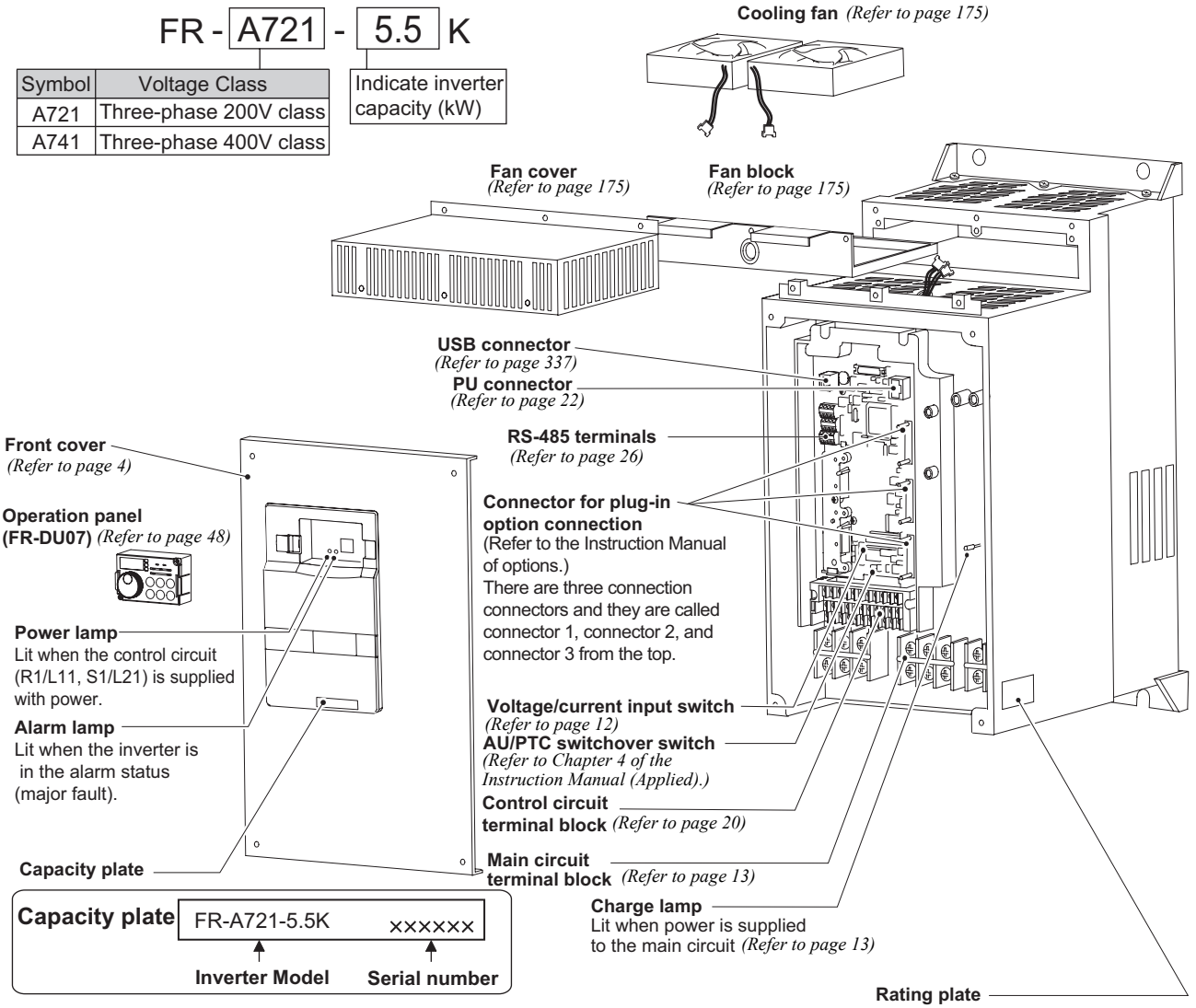
Unpack the inverter and check the capacity plate on the front cover and the rating plate on the inverter side face to ensure that the product agrees with your order and the inverter is intact.

- **Inverter Model**

FR - A721 - 5.5 K

Symbol	Voltage Class
A721	Three-phase 200V class
A741	Three-phase 400V class

Indicate inverter capacity (kW)



- **Accessory**

  · **Eyebolt for hanging the inverter**

Capacity	Eyebolt size	Quantity
11K, 15K	M8	2
18.5K to 30K	M10	2
37K to 55K	M12	2

* The 5.5K and 7.5K are not provided with eyebolts.

REMARKS

For removal and reinstallation of covers, refer to *page 4*.

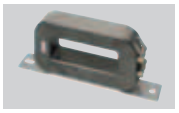
Harmonic suppression guideline (when inverters are used in Japan)
All models of general-purpose inverters used by specific consumers are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage". (*For details, refer to page 39 .*)

1.2 Inverter and peripheral devices

Three-phase AC power supply
Use within the permissible power supply specifications of the inverter.
(Refer to page 182)

Moulded case circuit breaker (MCCB) or earth leakage circuit breaker (ELB), fuse
The breaker must be selected carefully since an in-rush current flows in the inverter at power on.
(Refer to page 3)

Magnetic contactor (MC)
Install the magnetic contactor to ensure safety. Do not use this magnetic contactor to start and stop the inverter. Doing so will cause the inverter life to be shorten.
(Refer to page 3)



EMC filter (ferrite core) (FR-BLF)
Install a noise filter to reduce the electromagnetic noise generated from the inverter.
Effective in the range from about 1MHz to 10MHz.
When more wires are passed through, a more effective result can be obtained. The total number of wires passed through should be 4T or more.

USB connector
A personal computer and an inverter can be connected with a USB (Ver1. 1) cable.
(Refer to page 27)

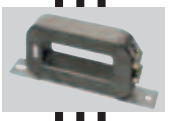
Inverter (FR-A701)
The life of the inverter is influenced by surrounding air temperature. The surrounding air temperature should be as low as possible within the permissible range. This must be noted especially when the inverter is installed in an enclosure. *(Refer to page 6)*
Wrong wiring might lead to damage of the inverter. The control signal lines must be kept fully away from the main circuit to protect them from noise.*(Refer to page 12)*

R/L1 S/L2 T/L3

EMC filter (capacitor) (FR-BIF)
Reduces the radio noise.

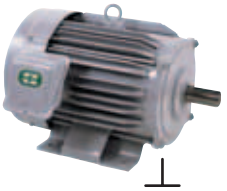
Earth (Ground)

U V W



EMC filter (ferrite core) (FR-BLF)
Install a noise filter to reduce the electromagnetic noise generated from the inverter.
Effective in the range from about 1MHz to 10MHz. A wire should be wound four turns at a maximum.

Motor



Earth (Ground)

Devices connected to the output
Do not install a power factor correction capacitor, surge suppressor or radio noise filter on the output side of the inverter. When installing a moulded case circuit breaker on the output side of the inverter, contact each manufacturer for selection of the moulded case circuit breaker.

Earth (Ground)
To prevent an electric shock, always earth (ground) the motor and inverter.

: Install these options as required.

CAUTION

- Do not install a power factor correction capacitor, surge suppressor or radio noise filter on the inverter output side. This will cause the inverter to trip or the capacitor, and surge suppressor to be damaged. If any of the above devices are connected, immediately remove them.
- This inverter has a built-in AC reactor (FR-HAL) and a circuit type specified in Harmonic suppression guideline in Japan is three-phase bridge (capacitor smoothed) and with reactor (AC side). *(Refer to page 39)* Do not use an AC reactor (FR-HAL) of a stand-alone option except following purpose. (Note that overload protection of the converter may operate when a thyristor load is connected in the power supply system. To prevent this, always install an optional stand-alone AC reactor (FR-HAL).) A DC reactor (FR-HEL) can not be connected to the inverter.
- Electromagnetic wave interference
  The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In this case, connecting a capacitor type filter will reduce electromagnetic wave interference.
- Refer to the instruction manual of each option and peripheral devices for details of peripheral devices.

1.2.1 Peripheral devices

Check the inverter model of the inverter you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following list and prepare appropriate peripheral devices:

200V class

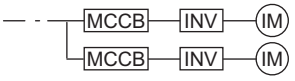
Motor Output (kW)*1	Applicable Inverter Model	Breaker Selection*2	Input Side Magnetic Contactor*3
5.5	FR-A721-5.5K	40A	S-N20, N21
7.5	FR-A721-7.5K	50A	S-N25
11	FR-A721-11K	75A	S-N35
15	FR-A721-15K	100A	S-N50
18.5	FR-A721-18.5K	125A	S-N50
22	FR-A721-22K	150A	S-N65
30	FR-A721-30K	175A	S-N80
37	FR-A721-37K	225A	S-N125
45	FR-A721-45K	300A	S-N150
55	FR-A721-55K	350A	S-N180

400V class

Motor Output (kW)*1	Applicable Inverter Model	Breaker Selection*2	Input Side Magnetic Contactor*3
5.5	FR-A741-5.5K	20A	S-N11, N12
7.5	FR-A741-7.5K	30A	S-N20, N21
11	FR-A741-11K	40A	S-N20, N21
15	FR-A741-15K	50A	S-N20, N21
18.5	FR-A741-18.5K	60A	S-N25
22	FR-A741-22K	75A	S-N25
30	FR-A741-30K	100A	S-N50
37	FR-A741-37K	125A	S-N50
45	FR-A741-45K	150A	S-N65
55	FR-A741-55K	175A	S-N80

*1 Selections for use of the Mitsubishi 4-pole standard motor with power supply voltage of 200VAC/400VAC 50Hz.

*2 Select the MCCB according to the inverter power supply capacity.
Install one MCCB per inverter.
For the use in the United States or Canada, provide the appropriate UL and cUL listed Class RK5 or Class T type fuse or UL 489 molded case circuit breaker (MCCB) that is suitable for branch circuit protection.
(Refer to page 199.)



*3 Magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stop during motor driving, the electrical durability is 25 times.
When using the MC for emergency stop during motor driving or using on the motor side during commercial-power supply operation, select the MC with class AC-3 rated current for the motor rated current.

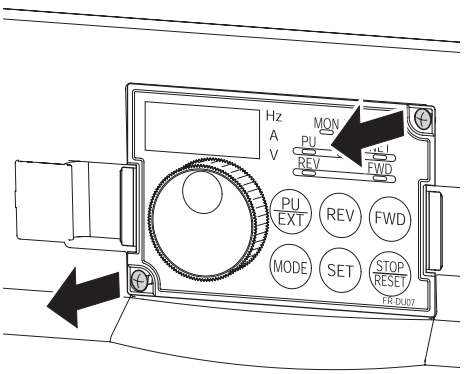
CAUTION

- When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model and cable according to the motor output.
- When the breaker on the inverter input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.

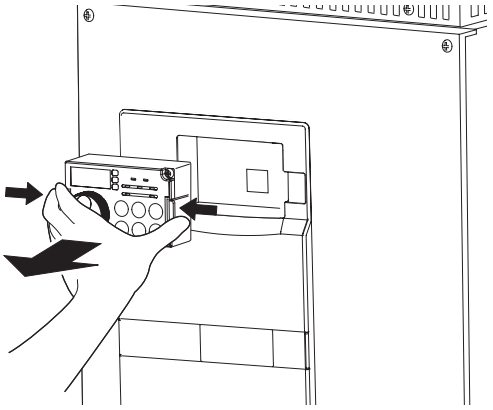
1.3 Method of removal and reinstallation of the front cover

•Removal of the operation panel

1) Loosen the two screws on the operation panel. (These screws cannot be removed.)



2) Push the left and right hooks of the operation panel and pull the operation panel toward you to remove.

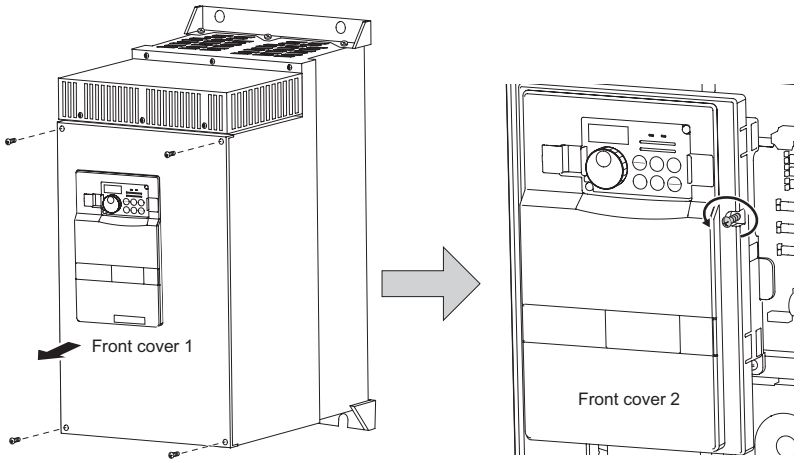


When reinstalling the operation panel, insert it straight to reinstall securely and tighten the fixed screws of the operation panel.

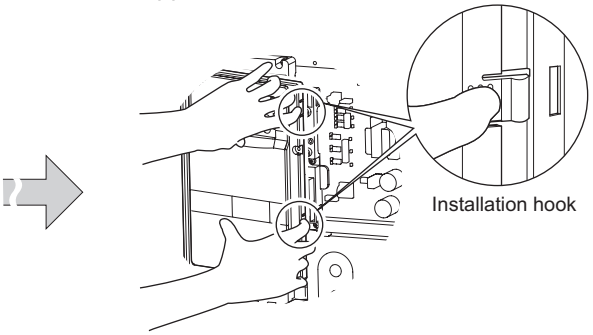
•Removal of the front cover

1) Remove installation screws on the front cover 1 to remove the front cover 1.

2) Loosen the installation screws of the front cover 2.



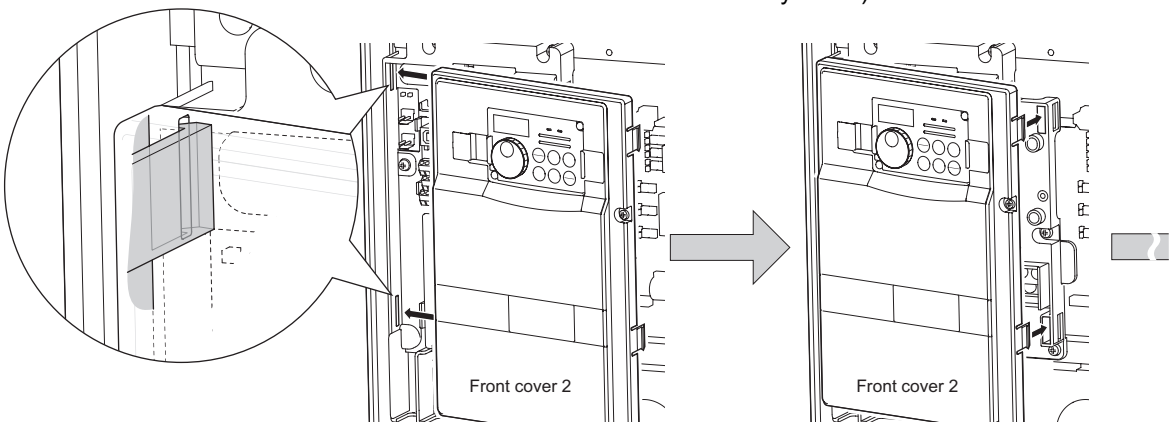
3) Pull the front cover 2 toward you to remove by pushing an installation hook on the right side using left fixed hooks as supports.



●**Reinstallation of the front cover**

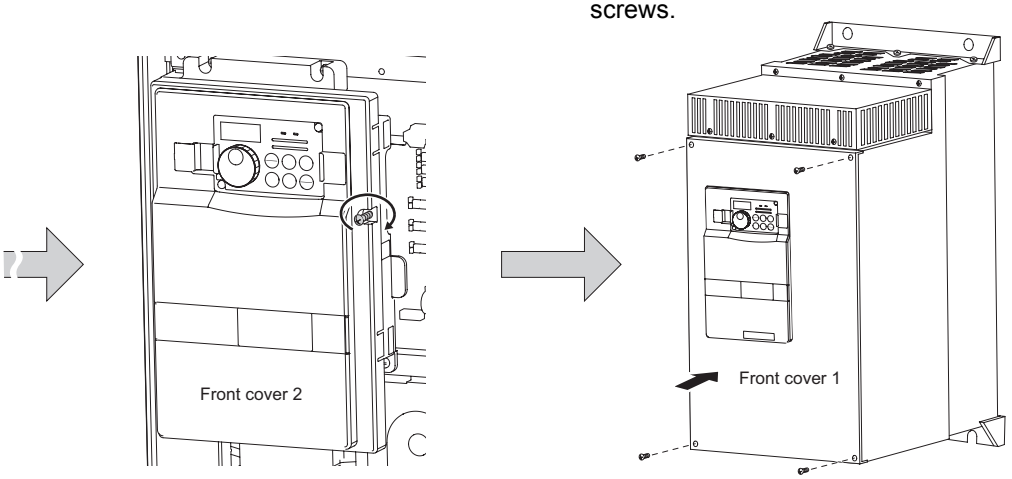
1) Insert the two fixed hooks on the left side of the front cover 2 into the sockets of the inverter.

2) Using the fixed hooks as supports, securely press the front cover 2 against the inverter.
(Although installation can be done with the operation panel mounted, make sure that a connector is securely fixed.)



3) Fix the front cover 2 with the installation screws.

4) Fix the front cover 1 with the installation screws.



REMARKS

· For the 55K, the front cover 1 is separated into two parts.

CAUTION

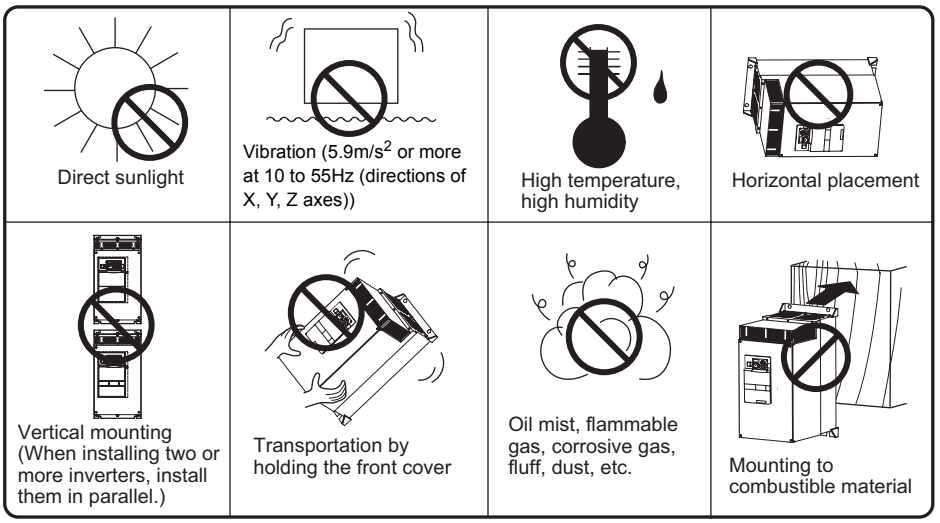
1. Fully make sure that the front cover has been reinstalled securely. Always tighten the installation screws of the front cover.
2. The same serial number is printed on the capacity plate of the front cover and the rating plate of the inverter. Before reinstalling the front cover, check the serial numbers to ensure that the cover removed is reinstalled to the inverter from where it was removed.

1.4 Installation of the inverter and enclosure design

When an inverter enclosure is to be designed and manufactured, heat generated by contained equipment, etc., the environment of an operating place, and others must be fully considered to determine the enclosure structure, size and equipment layout. The inverter unit uses many semiconductor devices. To ensure higher reliability and long period of operation, operate the inverter in the ambient environment that completely satisfies the equipment specifications.

1.4.1 Inverter installation environment

The inverter consists of precision mechanical and electronic parts. Never install or handle it in any of the following conditions as doing so could cause an operation fault or failure.



As the inverter installation environment should satisfy the standard specifications indicated in the following table, operation in any place that does not meet these conditions not only deteriorates the performance and life of the inverter, but also causes a failure. Refer to the following points and take adequate measures.

Environmental standard specifications of inverter

Item	Description
Surrounding air temperature	-10°C to +50°C (non-freezing)
Ambient humidity	90% RH maximum (non-condensing)
Atmosphere	Free from corrosive and explosive gases, dust and dirt
Maximum Altitude	1,000m or less
Vibration	5.9m/s^2 or less at 10 to 55Hz (directions of X, Y, Z axes)

(1) Temperature

The permissible surrounding air temperature of the inverter is between -10°C and +50°C. Always operate the inverter within this temperature range. Operation outside this range will considerably shorten the service lives of the semiconductors, parts, capacitors and others. Take the following measures so that the surrounding air temperature of the inverter falls within the specified range.

1) Measures against high temperature
   - Use a forced ventilation system or similar cooling system. *(Refer to page 9.)*
   - Install the enclosure in an air-conditioned electrical chamber.
   - Block direct sunlight.
   - Provide a shield or similar plate to avoid direct exposure to the radiated heat and wind of a heat source.
   - Ventilate the area around the enclosure well.

2) Measures against low temperature
   - Provide a space heater in the enclosure.
   - Do not power off the inverter. (Keep the start signal of the inverter off.)

3) Sudden temperature changes
   - Select an installation place where temperature does not change suddenly.
   - Avoid installing the inverter near the air outlet of an air conditioner.
   - If temperature changes are caused by opening/closing of a door, install the inverter away from the door.

(2) Humidity

Normally operate the inverter within the 45 to 90% range of the ambient humidity. Too high humidity will pose problems of reduced insulation and metal corrosion. On the other hand, too low humidity may produce a spatial electrical breakdown. The insulation distance specified in JEM1103 "Control Equipment Insulator" is defined as humidity 45 to 85%.

1) Measures against high humidity
   - Make the enclosure enclosed, and provide it with a hygroscopic agent.
   - Take dry air into the enclosure from outside.
   - Provide a space heater in the enclosure.

2) Measures against low humidity
   What is important in fitting or inspection of the unit in this status is to discharge your body (static electricity) beforehand and keep your body from contact with the parts and patterns, besides blowing air of proper humidity into the enclosure from outside.

3) Measures against condensation
   Condensation may occur if frequent operation stops change the in-enclosure temperature suddenly or if the outside-air temperature changes suddenly.
   Condensation causes such faults as reduced insulation and corrosion.
   - Take the measures against high humidity in 1).
   - Do not power off the inverter. (Keep the start signal of the inverter off.)

(3) Dust, dirt, oil mist

Dust and dirt will cause such faults as poor contact of contact points, reduced insulation or reduced cooling effect due to moisture absorption of accumulated dust and dirt, and in-enclosure temperature rise due to clogged filter.
In the atmosphere where conductive powder floats, dust and dirt will cause such faults as malfunction, deteriorated insulation and short circuit in a short time.
Since oil mist will cause similar conditions, it is necessary to take adequate measures.

Countermeasures
- Place in a totally enclosed enclosure.
  Take measures if the in-enclosure temperature rises. *(Refer to page 9.)*
- Purge air.
  Pump clean air from outside to make the in-enclosure pressure higher than the outside-air pressure.

(4) Corrosive gas, salt damage

If the inverter is exposed to corrosive gas or to salt near a beach, the printed board patterns and parts will corrode or the relays and switches will result in poor contact.
In such places, take the measures given in Section (3).

(5) Explosive, flammable gases

As the inverter is non-explosion proof, it must be contained in an explosion proof enclosure.
In places where explosion may be caused by explosive gas, dust or dirt, an enclosure cannot be used unless it structurally complies with the guidelines and has passed the specified tests. This makes the enclosure itself expensive (including the test charges).
The best way is to avoid installation in such places and install the inverter in a non-hazardous place.

(6) Highland

Use the inverter at the altitude of within 1000m.
If it is used at a higher place, it is likely that thin air will reduce the cooling effect and low air pressure will deteriorate dielectric strength.

(7) Vibration, impact

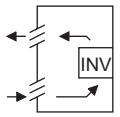
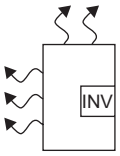
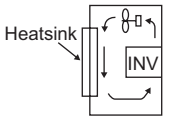
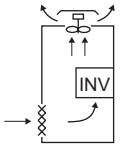
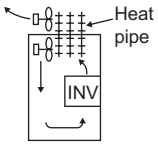
The vibration resistance of the inverter is up to 5.9m/s^2 at 10 to 55Hz frequency (directions of X, Y, Z axes) and 1mm amplitude.
Vibration or impact, if less than the specified value, applied for a long time may make the mechanism loose or cause poor contact to the connectors.
Especially when impact is imposed repeatedly, caution must be taken as the part pins are likely to break.

Countermeasures
- Provide the enclosure with rubber vibration isolators.
- Strengthen the structure to prevent the enclosure from resonance.
- Install the enclosure away from sources of vibration.

1.4.2 Cooling system types for inverter enclosure

From the enclosure that contains the inverter, the heat of the inverter and other equipment (transformers, lamps, resistors, etc.) and the incoming heat such as direct sunlight must be dissipated to keep the in-enclosure temperature lower than the permissible temperatures of the in-enclosure equipment including the inverter.
The cooling systems are classified as follows in terms of the cooling calculation method.

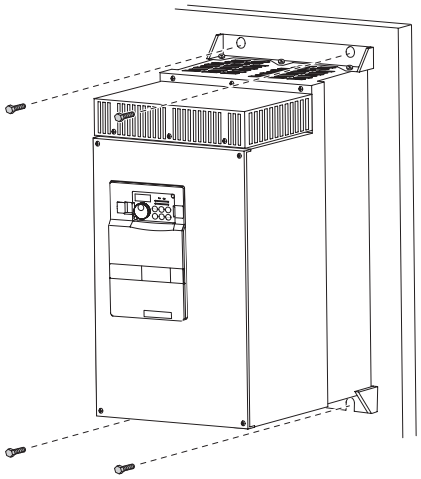
1) Cooling by natural heat dissipation from the enclosure surface (Totally enclosed type)
2) Cooling by heat sink (Aluminum heatsink, etc.)
3) Cooling by ventilation (Forced ventilation type, pipe ventilation type)
4) Cooling by heat exchanger or cooler (Heat pipe, cooler, etc.)

Cooling System		Enclosure Structure	Comment
Natural cooling	Natural ventilation (Enclosed, open type)		Low in cost and generally used, but the enclosure size increases as the inverter capacity increases. For relatively small capacities.
	Natural ventilation (Totally enclosed type)		Being a totally enclosed type, the most appropriate for hostile environment having dust, dirt, oil mist, etc. The enclosure size increases depending on the inverter capacity.
Forced cooling	Heatsink cooling		Having restrictions on the heatsink mounting position and area, and designed for relative small capacities.
	Forced ventilation		For general indoor installation. Appropriate for enclosure downsizing and cost reduction, and often used.
	Heat pipe		Totally enclosed type for enclosure downsizing.

1.4.3 Inverter placement

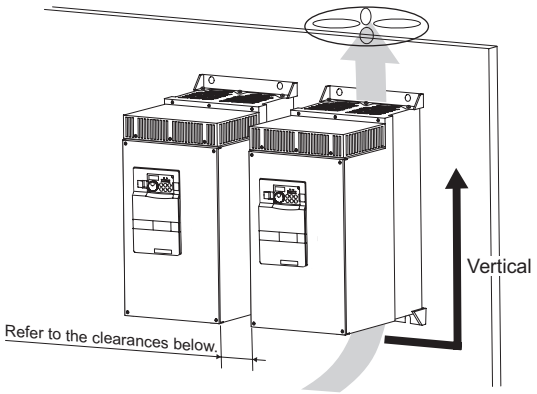
(1) Installation of the Inverter

Installation on the enclosure



CAUTION

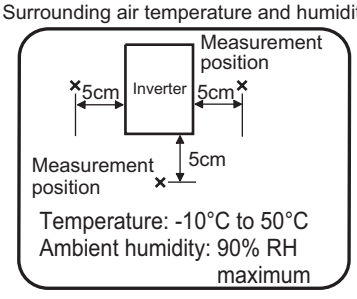
- When encasing multiple inverters, install them in parallel as a cooling measure.
- Install the inverter vertically.



(2) Clearances around the inverter

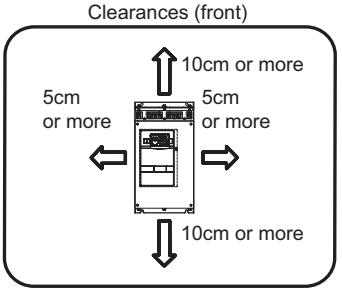
To ensure ease of heat dissipation and maintenance, leave at least the shown clearances around the inverter. At least the following clearances are required under the inverter as a wiring space, and above the inverter as a heat dissipation space.

Surrounding air temperature and humidity

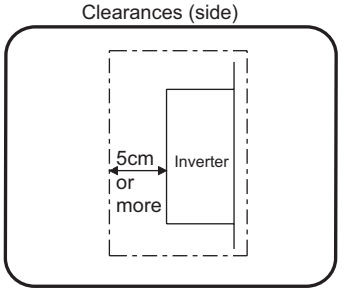


Leave enough clearances and take cooling measures.

Clearances (front)



Clearances (side)



REMARKS

For replacing the cooling fan, 30cm of space is necessary in front of the inverter. Refer to *page 175* for fan replacement.

(3) Inverter mounting orientation

Mount the inverter on a wall as specified. Do not mount it horizontally or any other way.

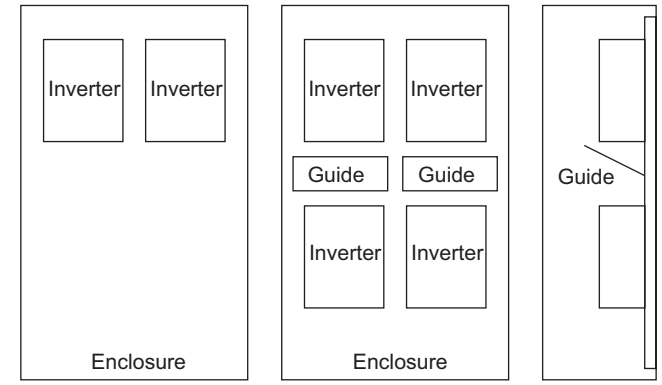
(4) Above the inverter

Heat is blown up from inside the inverter by the small fan built in the unit. Any equipment placed above the inverter should be heat resistant.

(5) Arrangement of multiple inverters

When multiple inverters are placed in the same enclosure, generally arrange them horizontally as shown in the figure below (a). When it is inevitable to arrange them vertically to minimize space, take such measures as to provide guides since heat from the bottom inverters can increase the temperatures in the top inverters, causing inverter failures.

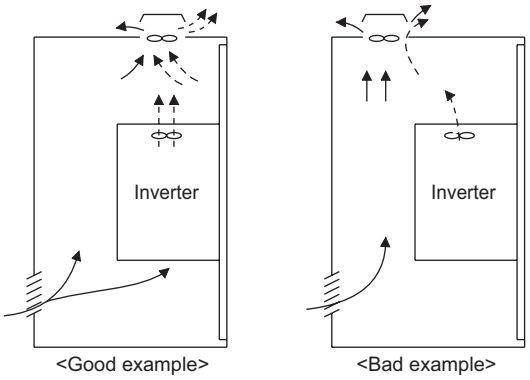
When mounting multiple inverters, fully take caution not to make the surrounding air temperature of the inverter higher than the permissible value by providing ventilation and increasing the enclosure size.



Arrangement of multiple inverters

(6) Placement of ventilation fan and inverter

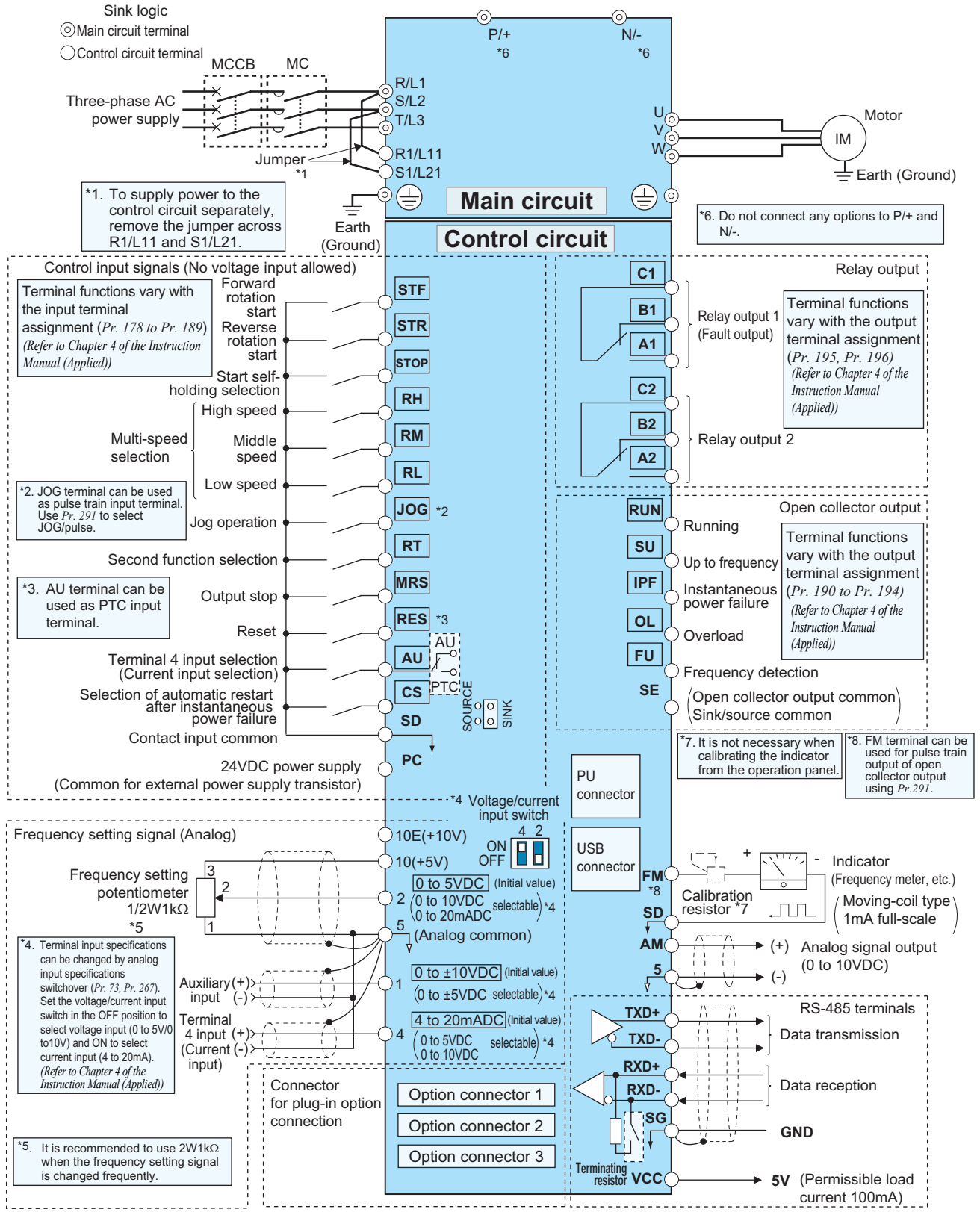
Heat generated in the inverter is blown up from the bottom of the unit as warm air by the cooling fan. When installing a ventilation fan for that heat, determine the place of ventilation fan installation after fully considering an air flow. (Air passes through areas of low resistance. Make an airway and airflow plates to expose the inverter to cool air.)



Placement of ventilation fan and inverter

2 WIRING

2.1 Terminal connection diagram



CAUTION

- To prevent a malfunction due to noise, keep the signal cables more than 10cm away from the power cables. Also separate the main circuit wire of the input side and the output side.
- After wiring, wire offcuts must not be left in the inverter.
  Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean.
  When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the inverter.
- Set the voltage/current input switch correctly. Different setting may cause a fault, failure or malfunction.

2.2 Main circuit terminal specifications

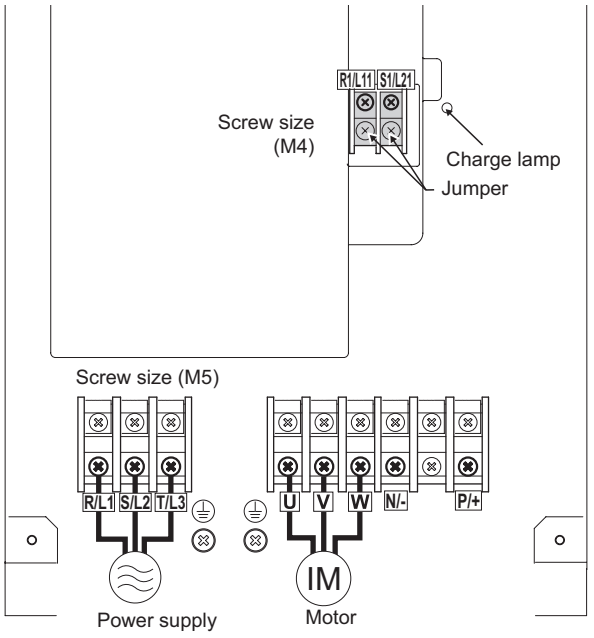
2.2.1 Specification of main circuit terminal

Terminal Symbol	Terminal Name	Description
R/L1, S/L2, T/L3	**AC power input**	Connect to the commercial power supply.
U, V, W	**Inverter output**	Connect a three-phase squirrel-cage motor.
R1/L11, S1/L21	**Power supply for control circuit**	Connected to the AC power supply terminals R/L1 and S/L2. To retain the fault display and fault output, remove the jumpers from terminals R/L1-R1/L11 and S/L2-S1/L21 and apply external power to these terminals. Do not turn off the power supply for control circuit (R1/L11, S1/L21) with the main circuit power (R/L1, S/L2, T/L3) on. Doing so may damage the inverter. The circuit should be configured so that the main circuit power (R/L1, S/L2, T/L3) is also turned off when the power supply for control circuit (R1/L11, S1/L21) is off. The following power supply capacities are required to supply power separately from R1/L11 and S1/L21: 90VA for 15K or lower, 100VA for 18.5K or higher
P/+, N/-	**DC terminal**	Do not connect any options.
⏚	**Earth (Ground)**	For earthing (grounding) the inverter chassis. Must be earthed (grounded).

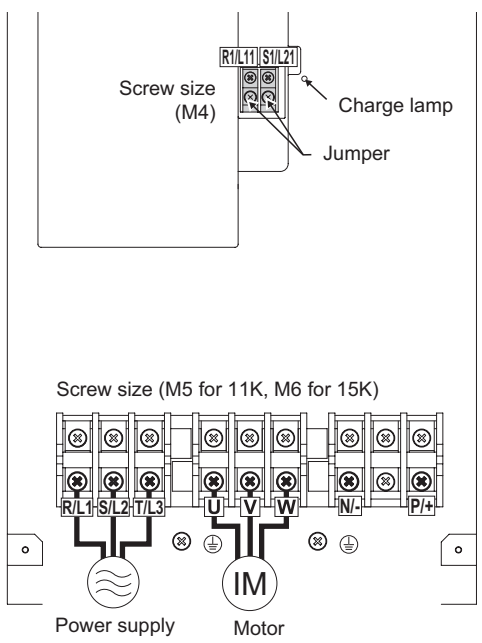
2.2.2 Terminal arrangement of the main circuit terminal, power supply and the motor wiring

200V class

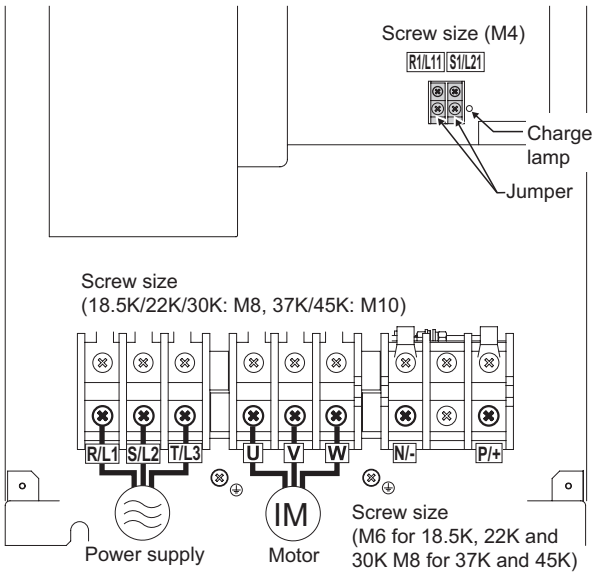
FR-A721-5.5K, 7.5K



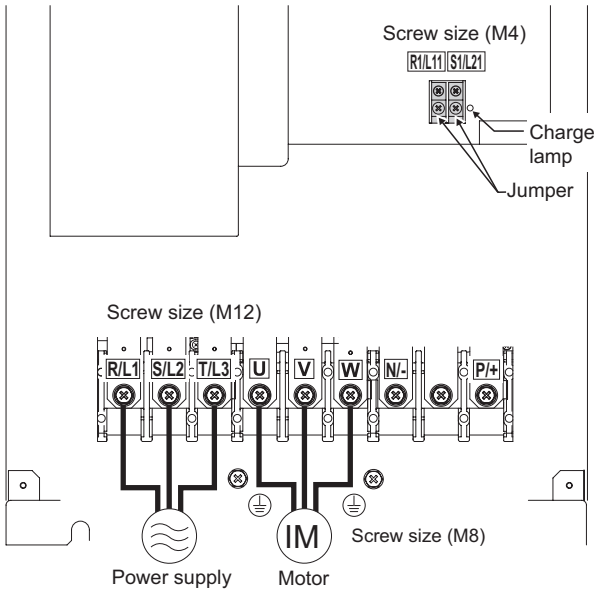
FR-A721-11K, 15K



FR-A721-18.5K to 45K

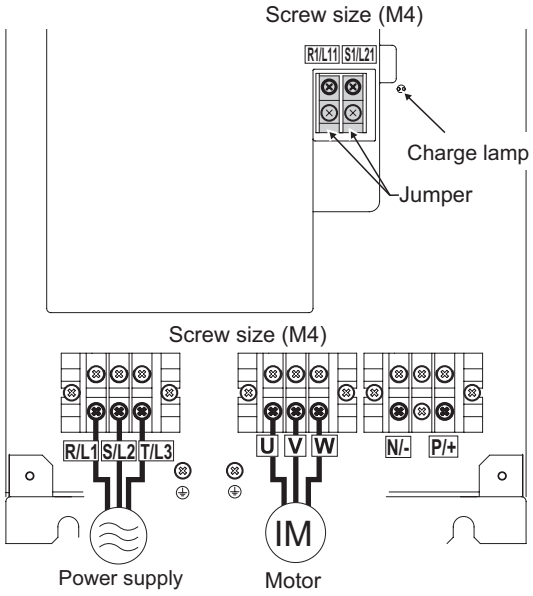


FR-A721-55K

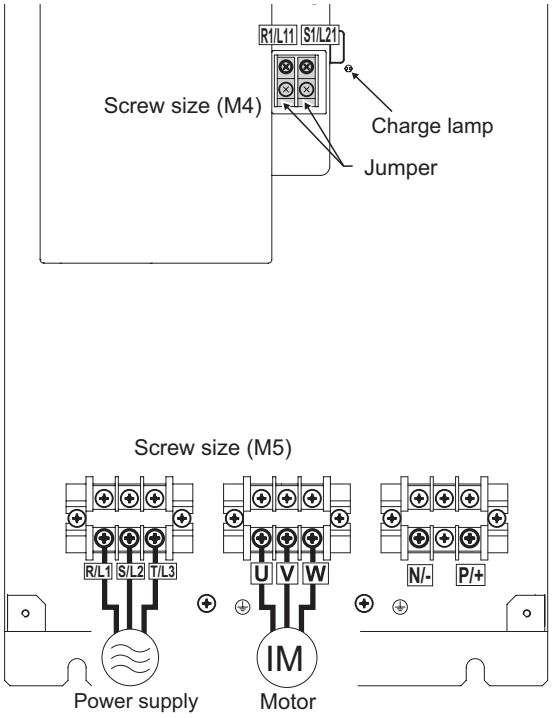


400V class

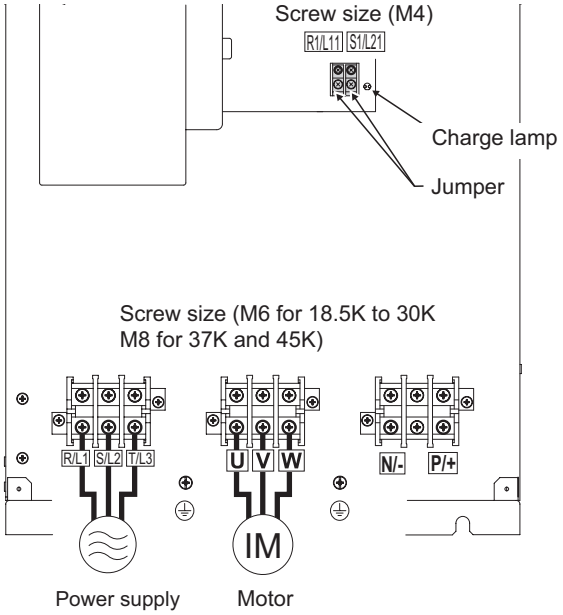
FR-A741-5.5K, 7.5K



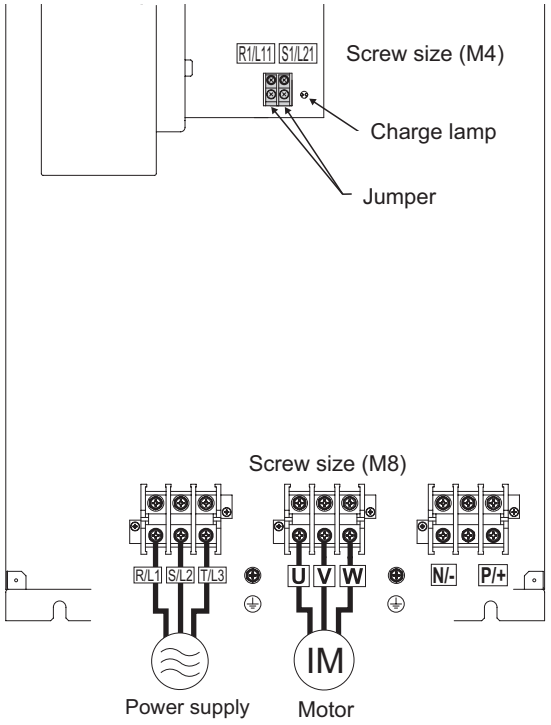
FR-A741-11K, 15K



FR-A741-18.5K to 45K



FR-A741-55K



CAUTION

- The power supply cables must be connected to R/L1, S/L2, T/L3. (Phase sequence needs not to be matched.) Never connect the power cable to the U, V, W of the inverter. Doing so will damage the inverter.
- Connect the motor to U, V, W. At this time, turning ON the forward rotation switch (signal) rotates the motor in the counterclockwise direction when viewed from the motor shaft.

2.2.3 Cables and wiring length

(1) Applicable cable size

Select the recommended cable size to ensure that a voltage drop will be 2% or less.
If the wiring distance is long between the inverter and motor, a main circuit cable voltage drop will cause the motor torque to decrease especially at the output of a low frequency.
The following table indicates a selection example for the wiring length of 20m.

200V class (when input power supply is 220V)

Applicable Inverter Model	Terminal Screw Size *4	Tightening Torque N·m	Crimping Terminal		Cable Sizes							
					HIV, etc. (mm²) *1			AWG/MCM *2		PVC, etc. (mm²) *3		
			R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing cable	R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing cable
FR-A721-5.5K	M5	2.5	5.5-5	5.5-5	5.5	5.5	5.5	10	10	6	6	6
FR-A721-7.5K	M5	2.5	14-5	8-5	14	8	5.5	6	8	16	10	16
FR-A721-11K	M5	2.5	14-5	14-5	14	14	14	6	6	16	16	16
FR-A721-15K	M6	4.4	22-6	22-6	22	22	14	4	4	25	25	16
FR-A721-18.5K	M8(M6)	7.8	38-8	38-8	38	38	22	2	2	35	35	25
FR-A721-22K	M8(M6)	7.8	38-8	38-8	38	38	22	2	2	35	35	25
FR-A721-30K	M8(M6)	7.8	60-8	60-8	60	60	22	1/0	1/0	50	50	25
FR-A721-37K	M10(M8)	14.7	80-10	80-10	80	80	22	3/0	3/0	70	70	35
FR-A721-45K	M10(M8)	14.7	100-10	100-10	100	100	38	4/0	4/0	95	95	50
FR-A721-55K	M12(M8)	24.5	100-12	100-12	100	100	38	4/0	4/0	95	95	50

*1 The cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.

*2 The recommended cable size is that of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
(Selection example for use mainly in the United States.)

*3 For the 15K or lower, the recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
For the 18.5K or higher, the recommended cable size is that of the cable (XLPE cable) with continuous maximum permissible temperature of 90°C. Assumes that the surrounding air temperature is 40°C or less and wiring is performed in an enclosure.
(Selection example for use mainly in Europe.)

*4 The terminal screw size indicates the terminal size for R/L1, S/L2, T/L3, U, V, W, and a screw for earthing (grounding).
A screw for earthing (grounding) of the 18.5K or higher is indicated in ( ).

400V class (when input power supply is 440V)

Applicable Inverter Model	Terminal Screw Size *4	Tightening Torque N·m	Crimping Terminal		Cable Sizes							
					HIV, etc. (mm²) *1			AWG/MCM *2		PVC, etc. (mm²) *3		
			R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing Cable	R/L1, S/L2, T/L3	U, V, W	R/L1, S/L2, T/L3	U, V, W	Earthing Cable
FR-A741-5.5K	M4	1.5	2-4	2-4	2	2	3.5	12	14	2.5	2.5	4
FR-A741-7.5K	M4	1.5	5.5-4	5.5-4	3.5	3.5	3.5	12	12	4	4	4
FR-A741-11K	M5	2.5	5.5-5	5.5-5	5.5	5.5	8	10	10	6	6	10
FR-A741-15K	M5	2.5	8-5	8-5	8	8	8	8	8	10	10	10
FR-A741-18.5K	M6	4.4	14-6	8-6	14	8	14	6	8	16	10	16
FR-A741-22K	M6	4.4	14-6	14-6	14	14	14	6	6	16	16	16
FR-A741-30K	M6	4.4	22-6	22-6	22	22	14	4	4	25	25	16
FR-A741-37K	M8	7.8	22-8	22-8	22	22	14	4	4	25	25	16
FR-A741-45K	M8	7.8	38-8	38-8	38	38	22	1	2	50	50	25
FR-A741-55K	M8	7.8	60-8	60-8	60	60	22	1/0	1/0	50	50	25

*1 The cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.

*2 For the 45K or lower, the recommended cable size is that of the cable (THHW cable) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 40°C or less and the wiring distance is 20m or less.
For the 55K, the recommended cable size is that of the cable (THHN cable) with continuous maximum permissible temperature of 90°C. Assumes that the surrounding air temperature is 40°C or less and wiring is performed in an enclosure.
(Selection example for use mainly in the United States.)

*3 For the 45K or lower, the recommended cable size is that of the cable (PVC cable) with continuous maximum permissible temperature of 70°C. Assumes that the ambient temperature is 40°C or less and the wiring distance is 20m or less.
For the 55K, the recommended cable size is that of the cable (XLPE cable) with continuous maximum permissible temperature of 90°C. Assumes that the ambient temperature is 40°C or less and wiring is performed in an enclosure.
(Selection example for use mainly in Europe.)

The line voltage drop can be calculated by the following formula:

$$\text{Line voltage drop [V]} = \frac{\sqrt{3} \times \text{wire resistance[m}\Omega\text{/m]} \times \text{wiring distance[m]} \times \text{current[A]}}{1000}$$

Use a larger diameter cable when the wiring distance is long or when it is desired to decrease the voltage drop (torque reduction) in the low speed range.

CAUTION

- Tighten the terminal screw to the specified torque.
  A screw that has been tighten too loosely can cause a short circuit or malfunction.
  A screw that has been tighten too tightly can cause a short circuit or malfunction due to the unit breakage.
- Use crimping terminals with insulation sleeve to wire the power supply and motor.

(2) Notes on earthing (grounding)

● Always earth (ground) the motor and inverter.

1)Purpose of earthing (grounding)

Generally, an electrical apparatus has an earth (ground) terminal, which must be connected to the ground before use.

An electrical circuit is usually insulated by an insulating material and encased. However, it is impossible to manufacture an insulating material that can shut off a leakage current completely, and actually, a slight current flow into the case. The purpose of earthing (grounding) the case of an electrical apparatus is to prevent operator from getting an electric shock from this leakage current when touching it.

To avoid the influence of external noises, this earthing (grounding) is important to audio equipment, sensors, computers and other apparatuses that handle low-level signals or operate very fast.

2)Earthing (grounding) methods and earthing (grounding) work

As described previously, earthing (grounding) is roughly classified into an electrical shock prevention type and a noise-affected malfunction prevention type. Therefore, these two types should be discriminated clearly, and the following work must be done to prevent the leakage current having the inverter's high frequency components from entering the malfunction prevention type earthing (grounding):

(a) If possible, use (I) independent earthing (grounding) in figure below for the inverter. If independent earthing (grounding) is not available, use (II) joint earthing (grounding) in the figure below which the inverter is connected with the other equipment at an earthing (grounding) point. The (III) common earthing (grounding) as in the figure below, which inverter shares a common earth (ground) cable with the other equipment, must be avoided.

A leakage current including many high frequency components flows in the earth (ground) cables of the inverter and inverter-driven motor. Therefore, use the independent earthing (grounding) and separated the earthing (grounding) cable of the inverter from equipments sensitive to EMI.

In a high building, it may be effective to use the EMI prevention type earthing (grounding) connecting to an iron structure frame, and electric shock prevention type earthing (grounding) with the independent earthing (grounding) together.

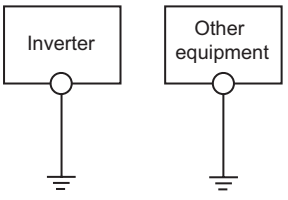
(b) This inverter must be earthed (grounded). Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards).

Use a neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard.

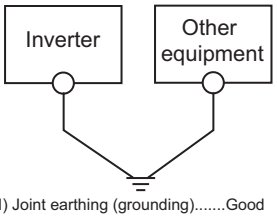
(c) Use the thickest possible earth (ground) cable. The earth (ground) cable should be of not less than the size indicated in the table on the previous page.

(d) The grounding point should be as near as possible to the inverter, and the ground wire length should be as short as possible.

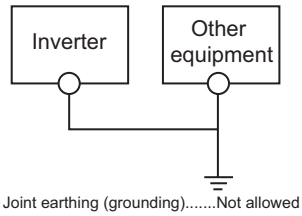
(e) Run the earth (ground) cable as far away as possible from the I/O wiring of equipment sensitive to noises and run them in parallel in the minimum distance.



(I) Independent earthing (grounding).....Best



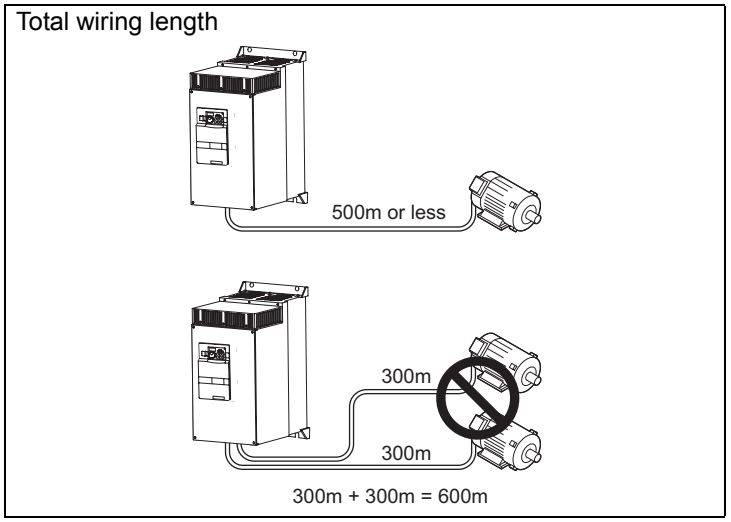
(II) Joint earthing (grounding).....Good



(III) Joint earthing (grounding).....Not allowed

(3) Total wiring length

The overall wiring length for the connection to a single motor or multiple motors should be within 500m (with unshielded wires).
(The wiring length should be within 100m for the operation under vector control or when using shielded wires.)



When driving a 400V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor.
Refer to *page 42* for measures against deteriorated insulation.

CAUTION

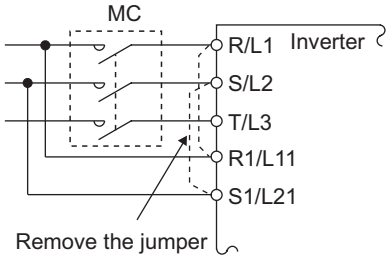
- Especially with the long-distance wiring and the wiring with shielded wires, the inverter may be affected by a charging current caused by the stray capacitance from the wiring, leading to a malfunction of the overcurrent protective function or the fast response current limit function, or an inverter fault. It may also lead to a malfunction or fault of the equipment connected on the inverter output side. Stray capacitance from the wiring varies with its wiring conditions. The overall wiring length specified above is only a reference value. If the fast-response current limit function malfunctions, disable this function. (For *Pr. 156 Stall prevention operation selection, refer to Chapter 4 of* 📖 *the Instruction Manual (Applied).*)
- For explanation of the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) and sine wave filter (MT-BSL/BSC), refer to the manual of each option.
- Do not connect a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) during the operation under vector control.

(4) Cable size of the control circuit power supply (terminal R1/L11, S1/L21)

- Terminal screw size: M4
- Cable size: 0.75mm^2 to 2mm^2
- Tightening torque: 1.5N·m

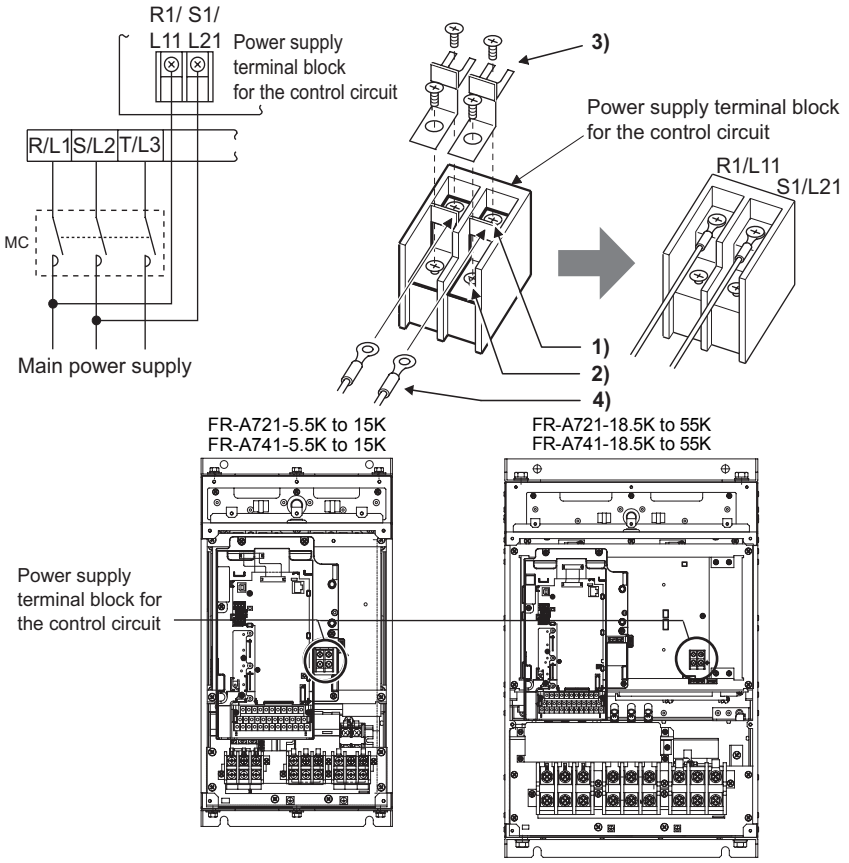
2.2.4 When connecting the control circuit and the main circuit separately to the power supply

<Connection diagram>



1) Remove the upper screws.
2) Remove the lower screws.
3) Pull the jumper toward you to remove.
4) Connect the separate power supply cable for the control circuit to the **upper terminals (R1/L11, S1/L21).**

When fault occurs, opening of the electromagnetic contactor (MC) on the inverter power supply side results in power loss in the control circuit, disabling the fault output signal retention. Terminals R1/L11 and S1/L21 are provided to hold a fault signal. In this case, connect the power supply terminals R1/L11 and S1/L21 of the control circuit to the input side of the MC. Do not connect the power cable to incorrect terminals. Doing so may damage the inverter.



CAUTION

- Do not turn off the control power (terminals R1/L11 and S1/L21) with the main circuit power (R/L1, S/L2, T/L3) on. Doing so may damage the inverter. Make up a circuit which will switch off the main circuit power supply terminals R/L1, S/L2, T/L3 when the control circuit power supply terminals R1/L11, S1/L21 are switched off.
- Be sure to use the inverter with the jumpers across terminals R/L1 and R1/L11 and across terminals S/L2 and S1/L21 removed when supplying power from other sources. The inverter may be damaged if you do not remove the jumper.
- The voltage should be the same as that of the main control circuit when the control circuit power is supplied from other than the input side of the MC.
- When separate power is supplied from R1/L11 and S1/L21, the power capacity necessary for the 15K or lower is 90VA, for the 18.5K or higher is 100VA.
- If the main circuit power is switched OFF (for 0.1s or more) then ON again, the inverter resets and a fault output will not be held.

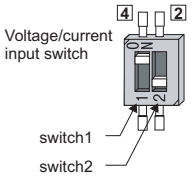
2.3 Control circuit specifications

2.3.1 Control circuit terminals

indicates that terminal functions can be selected using *Pr. 178 to Pr. 196 (I/O terminal function selection) (Refer to Chapter 4 of the Instruction Manual (Applied)*.)

(1) Input signals

Type	Terminal Symbol	Terminal Name	Description		Rated Specifications	Refer to page
Contact input	STF	Forward rotation start	Turn ON the STF signal to start forward rotation and turn it OFF to stop.	When the STF and STR signals are turned ON simultaneously, the stop command is given.	Input resistance 4.7kΩ Voltage at opening: 21 to 27VDC Contacts at short-circuited: 4 to 6mADC	92
	STR	Reverse rotation start	Turn ON the STR signal to start reverse rotation and turn it OFF to stop.			
	STOP	Start self-holding selection	Turn ON the STOP signal to self-hold the start signal.			*2
	RH, RM, RL	Multi-speed selection	Multi-speed can be selected according to the combination of RH, RM and RL signals.			94
	JOG	Jog mode selection	Turn ON the JOG signal to select Jog operation (initial setting) and turn ON the start signal (STF or STR) to start Jog operation.			*2
		Pulse train input	JOG terminal can be used as pulse train input terminal. To use as pulse train input terminal, the *Pr. 291* setting needs to be changed. (maximum input pulse: 100kpulses/s)		Input resistance 2kΩ Contacts at short-circuited: 8 to 13mADC	*2
	RT	Second function selection	Turn ON the RT signal to select second function. When the second function such as "second torque boost" and "second V/F (base frequency)" are set, turning on the RT signal selects these functions.		Input resistance 4.7kΩ Voltage at opening: 21 to 27VDC Contacts at short-circuited: 4 to 6mADC	*2
	MRS	Output stop	Turn ON the MRS signal (20ms or more) to stop the inverter output. Use to shut off the inverter output when stopping the motor by electromagnetic brake.			*2
	RES	Reset	Used to reset fault output provided when fault occurs. Turn ON the RES signal for more than 0.1s, then turn it OFF. Initial setting is for reset always. By setting *Pr. 75*, reset can be set to enabled only at fault occurrence. Recover about 1s after reset is cancelled.			141
	AU	Terminal 4 input selection	Terminal 4 is valid only when the AU signal is turned ON. (The frequency setting signal can be set between 4 and 20mADC.) Turning the AU signal ON makes terminal 2 (voltage input) invalid.			98
		PTC input	AU terminal is used as PTC input terminal (thermal protection of the motor). When using it as PTC input terminal, set the AU/PTC switch to PTC.			*2
	CS	Selection of automatic restart after instantaneous power failure	When the CS signal is left ON, the inverter restarts automatically at power restoration. Note that restart setting is necessary for this operation. In the initial setting, a restart is disabled. *(Refer to Pr. 57 Restart coasting time in Chapter 4 of the Instruction Manual (Applied).)*			*2
	SD	Contact input common (sink) (initial setting)	Common terminal for contact input terminal (sink logic) and terminal FM.		———	—
		External transistor common (source)	When connecting the transistor output (open collector output), such as a programmable controller, when source logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.			
		24VDC power supply common	Common output terminal for 24VDC 0.1A power supply (PC terminal). Isolated from terminals 5 and SE.			
	PC	External transistor common (sink) (initial setting)	When connecting the transistor output (open collector output), such as a programmable controller, when sink logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents.		Power supply voltage range 19.2 to 28.8VDC Permissible load current 100mA	24
		Contact input common (source)	Common terminal for contact input terminal (source logic).			
		24VDC power supply	Can be used as 24VDC 0.1A power supply.			

Type	Terminal Symbol	Terminal Name	Description	Rated Specifications	Refer to page
Frequency setting	10E	Frequency setting power supply	When connecting the frequency setting potentiometer at an initial status, connect it to terminal 10. Change the input specifications of terminal 2 when connecting it to terminal 10E. *(Refer to Pr. 73 Analog input selection in Chapter 4 of the Instruction Manual (Applied).)*	10VDC Permissible load current 10mA	*2
	10			5VDC Permissible load current 10mA	88, 96
	2	Frequency setting (voltage)	Inputting 0 to 5VDC (or 0 to 10V, 0 to 20mA) provides the maximum output frequency at 5V (10V, 20mA) and makes input and output proportional. Use *Pr. 73* to switch from among input 0 to 5VDC (initial setting), 0 to 10VDC, and 0 to 20mA. Set the voltage/current input switch in the ON position to select current input (0 to 20mA). *1	Voltage input: Input resistance 10kΩ ± 1kΩ Maximum permissible voltage 20VDC Current input: Input resistance 245Ω ± 5Ω Maximum permissible current 30mA 	88, 96
	4	Frequency setting (current)	Inputting 4 to 20mADC (or 0 to 5V, 0 to 10V) provides the maximum output frequency at 20mA makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). Use *Pr. 267* to switch from among input 4 to 20mA (initial setting), 0 to 5VDC, and 0 to 10VDC. Set the voltage/current input switch in the OFF position to select voltage input (0 to 5V/0 to 10V). *1 *(Refer to Chapter 4 of the Instruction Manual (Applied).)* Use *Pr. 858* to switch terminal functions.		90, 98
	1	Frequency setting auxiliary	Inputting 0 to ±5 VDC or 0 to ±10VDC adds this signal to terminal 2 or 4 frequency setting signal. Use *Pr. 73* to switch between the input 0 to ±5VDC and 0 to ±10VDC (initial setting). Use *Pr. 868* to switch terminal functions.	Input resistance 10kΩ ± 1kΩ Maximum permissible voltage ± 20VDC	*2
	5	Frequency setting common	Common terminal for frequency setting signal (terminal 2, 1 or 4) and analog output terminal AM. Do not earth (ground).	———	—

*1 Set *Pr. 73*, *Pr. 267*, and a voltage/current input switch correctly, then input an analog signal in accordance with the setting.
Applying a voltage signal with voltage/current input switch ON (current input is selected) or a current signal with switch OFF (voltage input is selected) could cause component damage of the inverter or analog circuit of signal output devices.

*2 *Refer to Chapter 4 of the Instruction Manual (Applied).*

(2) Output signals

Type	Terminal Symbol	Terminal Name	Description	Rated Specifications	Refer to page
Relay	A1, B1, C1	Relay output 1 (alarm output)	1 changeover contact output indicates that the inverter protective function has activated and the output stopped. Fault: No conduction between B and C (conduction between A and C) Normal: Conduction between B and C (No conduction between A and C)	Contact capacity: 230VAC 0.3A (Power factor=0.4) 30VDC 0.3A	*2
	A2, B2, C2	Relay output 2	1 changeover contact output		*2

Type	Terminal Symbol	Terminal Name	Description		Rated Specifications	Refer to page
Open collector	RUN	Inverter running	Switched low when the inverter output frequency is equal to or higher than the starting frequency (initial value 0.5Hz). Switched high during stop or DC injection brake operation. *1		Permissible load 24VDC (27VDC maximum) 0.1A (A voltage drop is 2.8V maximum when the signal is on.) *1 Low is when the open collector output transistor is ON (conducts). High is when the transistor is OFF (does not conduct).	*2
	SU	Up to frequency	Switched low when the output frequency reaches within the range of ±10% (initial value) of the set frequency. Switched high during acceleration/ deceleration and at a stop. *1	Alarm code (4bit) output		*2
	OL	Overload warning	Switched low when stall prevention is activated by the stall prevention function. Switched high when stall prevention is cancelled. *1			*2
	IPF	Instantaneous power failure	Switched low when an instantaneous power failure and under voltage protections are activated. *1			*2
	FU	Frequency detection	Switched low when the inverter output frequency is equal to or higher than the preset detected frequency and high when less than the preset detected frequency. *1			*2
	SE	Open collector output common	Common terminal for terminals RUN, SU, OL, IPF, FU		———	—
Pulse	FM	For meter	Select one e.g. output frequency from monitor items. Not output during inverter reset. The output signal is proportional to the magnitude of the corresponding monitoring item. To set a full-scale value for monitoring the output frequency and the output current, set *Pr. 56* and *Pr.158*. *2	Output item: Output frequency (initial setting)	Permissible load current 2mA 1440pulses/s at 60Hz	*2
		NPN open collector output		Signals can be output from the open collector terminals by setting *Pr. 291*.	Maximum output pulse: 50kpulses/s Permissible load current : 80mA	*2
Analog	AM	Analog signal output		Output item: Output frequency (initial setting)	Output signal 0 to 10VDC Permissible load current 1mA (load impedance 10kΩ or more) Resolution 8 bit	*2

*2 *Refer to Chapter 4 of the Instruction Manual (Applied).*

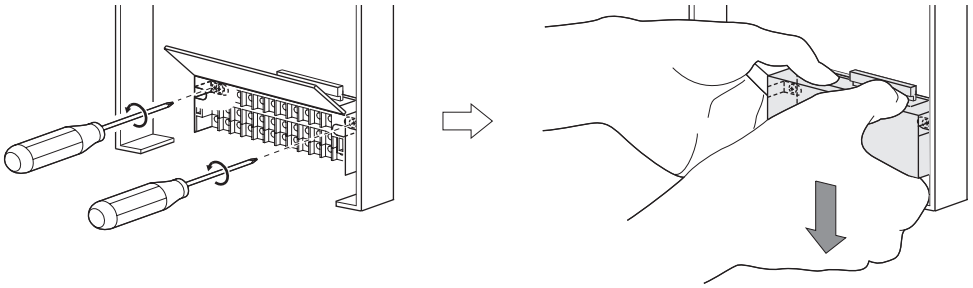
(3) Communication

Type	Terminal Symbol		Terminal Name	Description	Refer to page
RS-485	———		PU connector	With the PU connector, communication can be made through RS-485. (for connection on a 1:1 basis only) . Conforming standard : EIA-485 (RS-485) . Transmission format : Multidrop link . Communication speed : 4800 to 38400bps . Overall length : 500m	26
	RS-485 terminals	TXD+	Inverter transmission terminal	With the RS-485 terminals, communication can be made through RS-485. Conforming standard : EIA-485 (RS-485) Transmission format : Multidrop link Communication speed : 300 to 38400bps Overall length : 500m	26
		TXD-			
		RXD+	Inverter reception terminal		
		RXD-			
		SG	Earth (Ground)		
USB	———		USB connector	The FR Configurator can be used by connecting the inverter to the personal computer through USB. Interface:Conforms to USB1.1 Transmission speed:12Mbps Connector:USB B connector (B receptacle)	27

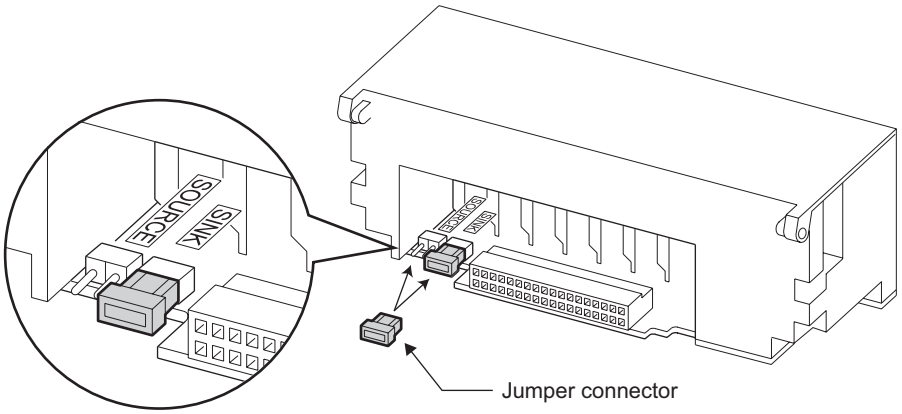
2.3.2 Changing the control logic

The input signals are set to sink logic (SINK) when shipped from the factory.
To change the control logic, the jumper connector on the back of the control circuit terminal block must be moved to the other position.
(The output signals may be used in either the sink or source logic independently of the jumper connector position.)

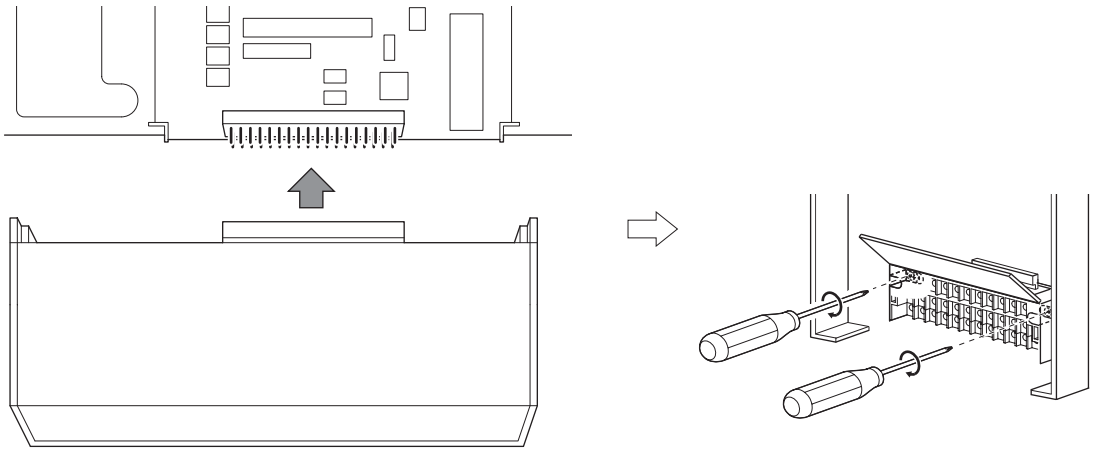
1) Loosen the two installation screws in both ends of the control circuit terminal block. (These screws cannot be removed.)
   Pull down the terminal block from behind the control circuit terminals.



2) Change the jumper connector set to the sink logic (SINK) on the rear panel of the control circuit terminal block to source logic (SOURCE).



3) Using care not to bend the pins of the inverter's control circuit connector, reinstall the control circuit terminal block and fix it with the mounting screws.



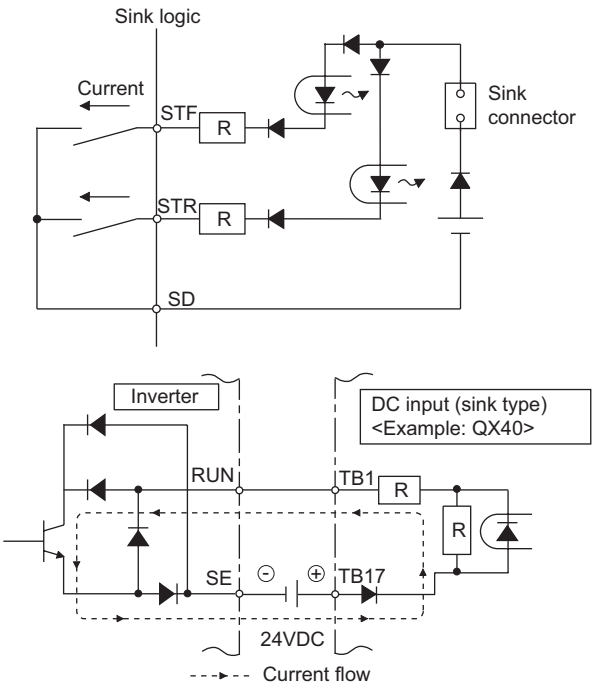
CAUTION

1. Make sure that the control circuit connector is fitted correctly.
2. While power is ON, never disconnect the control circuit terminal block.

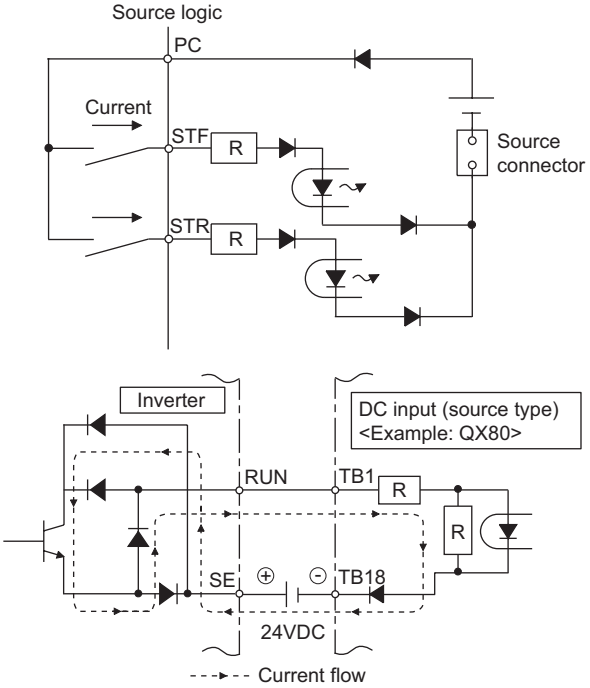
4) Sink logic and source logic

- In sink logic, a signal switches ON when a current flows from the corresponding signal input terminal. Terminal SD is common to the contact input signals. Terminal SE is common to the open collector output signals.
- In source logic, a signal switches ON when a current flows into the corresponding signal input terminal. Terminal PC is common to the contact input signals. Terminal SE is common to the open collector output signals.

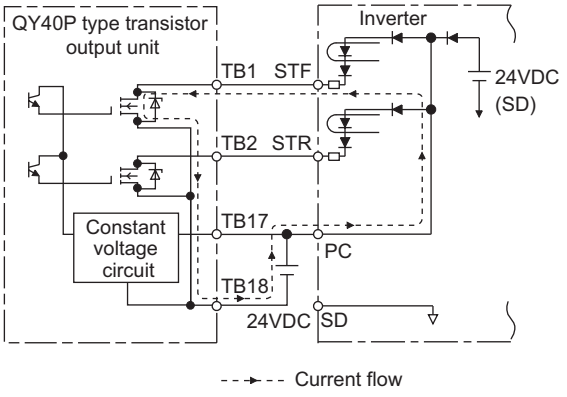
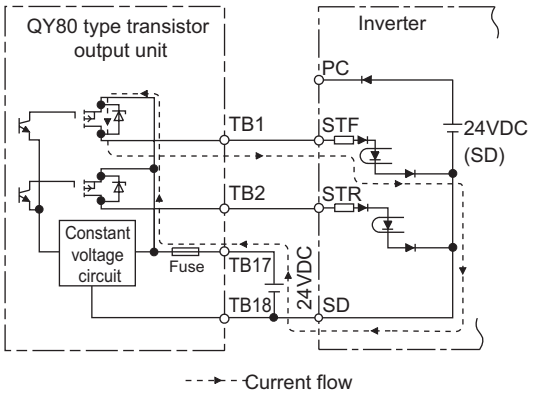
●Current flow concerning the input/output signal when sink logic is selected



●Current flow concerning the input/output signal when source logic is selected

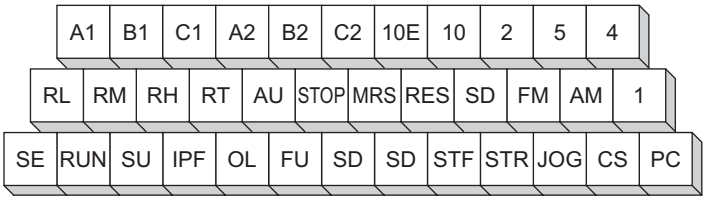


- When using an external power supply for transistor output

· Sink logic type Use terminal PC as a common terminal, and perform wiring as shown below. (Do not connect terminal SD of the inverter with terminal 0V of the external power supply. When using terminals PC and SD as a 24VDC power supply, do not install a power supply in parallel in the outside of the inverter. Doing so may cause a malfunction due to undesirable currents.)	· Source logic type Use terminal SD as a common terminal, and perform wiring as shown below. (Do not connect terminal PC of the inverter with terminal +24V of the external power supply. When using terminals PC and SD as a 24VDC power supply, do not install an external power supply in parallel with the inverter. Doing so may cause a malfunction in the inverter due to undesirable currents.)
	

2.3.3 Control circuit terminal layout

Terminal screw size: M3.5
Tightening torque: 1.2N·m

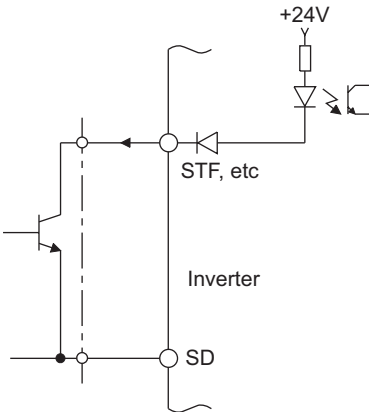


(1) Common terminals of the control circuit (SD, 5, SE)

Terminals SD, 5, and SE are all common terminals (0V) for I/O signals and are isolated from each other. Do not earth (ground) these terminals.
Avoid connecting the terminal SD and 5 and the terminal SE and 5.
Terminal SD is a common terminal for the contact input terminals (STF, STR, STOP, RH, RM, RL, JOG, RT, MRS, RES, AU, CS) and frequency output signal (FM).
The open collector circuit is isolated from the internal control circuit by photocoupler.
Terminal 5 is a common terminal for frequency setting signal (terminal 2, 1 or 4) and analog output terminal AM.
It should be protected from external noise using a shielded or twisted cable.
Terminal SE is a common terminal for the open collector output terminal (RUN, SU, OL, IPF, FU).
The contact input circuit is isolated from the internal control circuit by photocoupler.

(2) Signal inputs by contactless switches

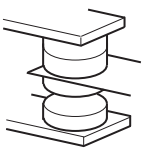
The contacted input terminals of the inverter (STF, STR, STOP, RH, RM, RL, JOG, RT, MRS, RES, AU, CS) can be controlled using a transistor instead of a contacted switch as shown on the right.

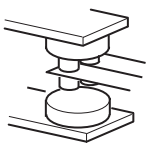


External signal input using transistor

2.3.4 Wiring instructions

1) It is recommended to use the cables of 0.75mm^2 gauge for connection to the control circuit terminals.
   If the cable gauge used is 1.25mm^2 or more, the front cover may be lifted when there are many cables running or the cables are run improperly, resulting in an operation panel contact fault.
2) The wiring length should be 30m(200m for terminal FM) maximum.
3) Use two or more parallel micro-signal contacts or twin contacts to prevent a contact faults when using contact inputs since the control circuit input signals are micro-currents.

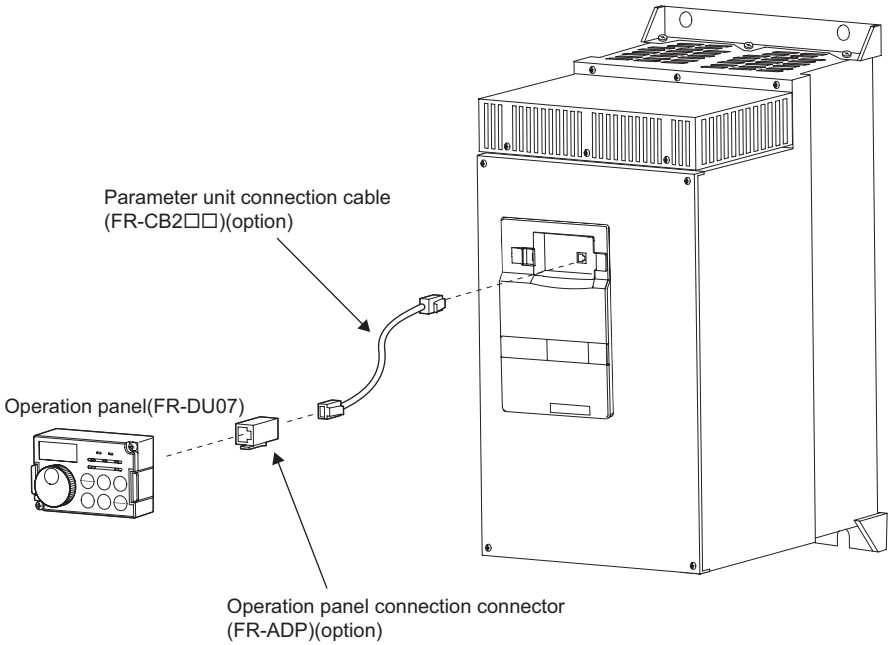

Micro signal contacts


Twin contacts

4) Use shielded or twisted cables for connection to the control circuit terminals and run them away from the main and power circuits (including the 200V relay sequence circuit).
5) Do not apply a voltage to the contact input terminals (e.g. STF) of the control circuit.
6) Always apply a voltage to the fault output terminals (A, B, C) via a relay coil, lamp, etc.

2.3.5 When connecting the operation panel using a connection cable

Having an operation panel on the enclosure surface is convenient. With a connection cable, you can mount the operation panel (FR-DU07) to the enclosure surface, and connect it to the inverter.



CAUTION

Do not connect the PU connector to the computer's LAN port, FAX modem socket or telephone connector.
The inverter and machine could be damaged due to differences in electrical specifications.

REMARKS

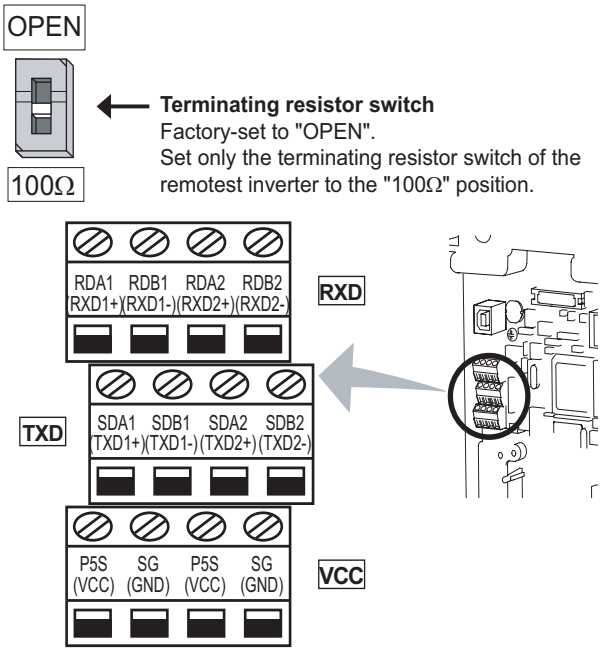
- Refer to *page 4* for removal method of the operation panel.
- Overall wiring length when the operation panel is connected: 20m maximum
- Refer to the following when fabricating the cable on the user side.
  Commercially available product examples (as of January 2010)

	Product	Type	Manufacturer
1)	Communication cable	SGLPEV-T (Cat5e/300m) 24AWG × 4P	Mitsubishi Cable Industries, Ltd.
2)	RJ-45 connector	5-554720-3	Tyco Electronics

- The inverter can be connected to the computer and FR-PU04/FR-PU07.

2.3.6 RS-485 terminal block

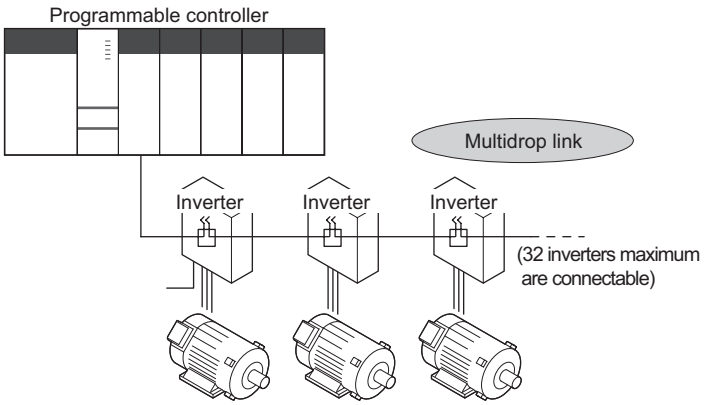
- Conforming standard: EIA-485(RS-485)
- Transmission format: Multidrop link
- Communication speed: MAX 38400bps
- Overall length: 500m
- Connection cable:Twisted pair cable (4 pairs)



2.3.7 Communication operation

Using the PU connector or RS-485 terminal, you can perform communication operation from a personal computer etc. When the PU connector is connected with a personal, FA or other computer by a communication cable, a user program can run and monitor the inverter or read and write to parameters.
For the Mitsubishi inverter protocol (computer link operation), communication can be performed with the PU connector and RS-485 terminal.
For the Modbus-RTU protocol, communication can be performed with the RS-485 terminal.

For further details, refer to *Chapter 4 of the Instruction Manual (Applied)*.

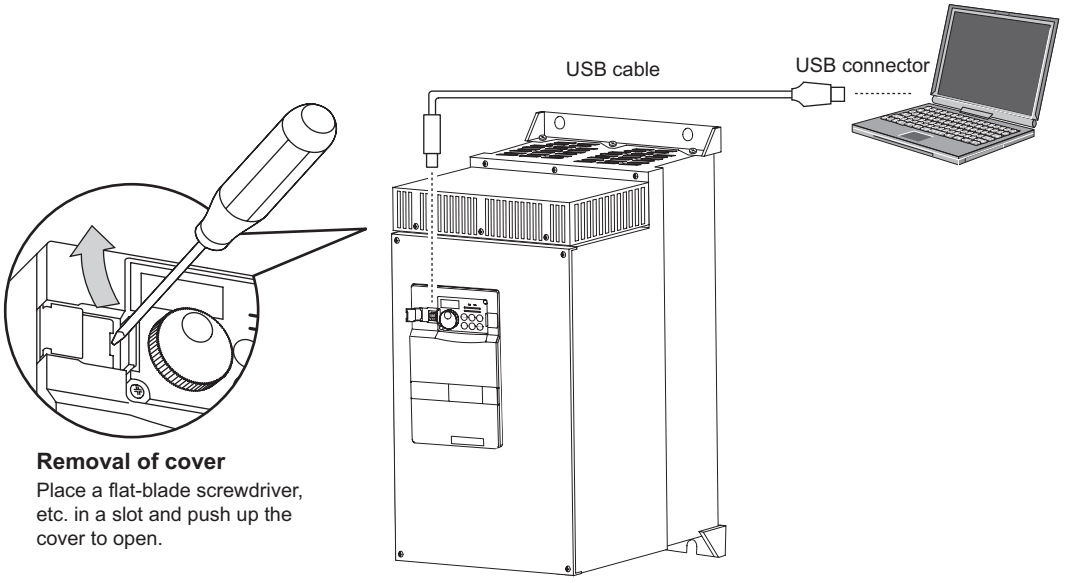


2.3.8 USB connector

A personal computer and an inverter can be connected with a USB (Ver1. 1) cable.
You can perform parameter setting and monitoring with the FR Configurator.

•USB communication specifications

Interface	Conforms to USB1.1
Transmission speed	12Mbps
Wiring length	Maximum 5m
Connector	USB B connector (B receptacle)
Power supply	Self-power supply

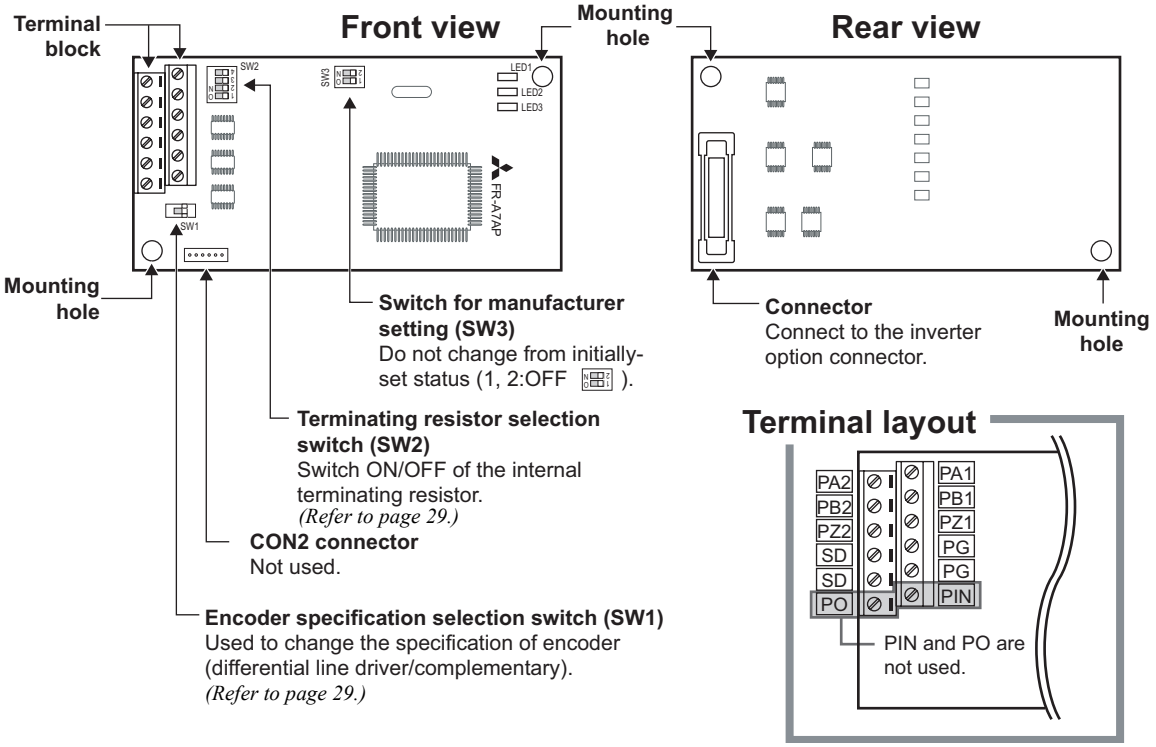


Removal of cover
Place a flat-blade screwdriver, etc. in a slot and push up the cover to open.

2.4 Connection of motor with encoder (vector control)

Orientation control and encoder feedback control, and speed control, torque control and position control by full-scale vector control operation can be performed using a motor with encoder and a plug-in option FR-A7AP.

(1) Structure of the FR-A7AP

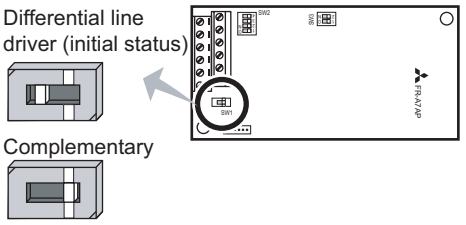


(2) Terminals of the FR-A7AP

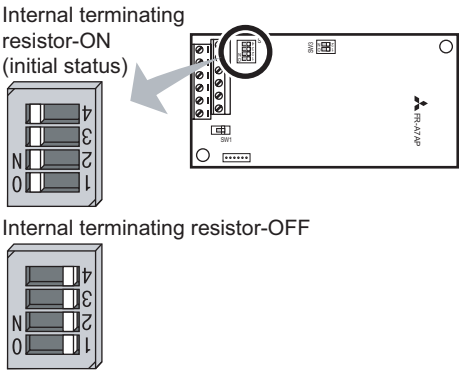
Terminal	Terminal Name	Description
PA1	Encoder A-phase signal input terminal	A-, B- and Z-phase signals are input from the encoder.
PA2	Encoder A-phase inverse signal input terminal	
PB1	Encoder B-phase signal input terminal	
PB2	Encoder B-phase inverse signal input terminal	
PZ1	Encoder Z-phase signal input terminal	
PZ2	Encoder Z-phase inversion signal input terminal	
PG	Encoder power supply (positive side) input terminal	Input terminal for the encoder power supply. Connect the external power supply (5V, 12V, 15V, 24V) and the encoder power cable.
SD	Encoder power supply ground terminal	
PIN	Not used.	
PO		

(3) Switches of the FR-A7AP

• Encoder specification selection switch (SW1)
Select either differential line driver or complementary
It is initially set to the differential line driver. Switch its position according to output circuit.



• Terminating resistor selection switch (SW2)
Select ON/OFF of the internal terminating resistor. Set the switch to ON (initial status) when an encoder output type is differential line driver and set to OFF when complementary.
ON : with internal terminating resistor (initial status)
OFF : without internal terminating resistor



REMARKS

- Set all switches to the same setting (ON/OFF).
- If the encoder output type is differential line driver, set the terminating resistor switch to the "OFF" position when sharing the same encoder with other unit (NC (numerical controller), etc.) or a terminating resistor is connected to other unit.

• Motor used and switch setting

Motor		Encoder Specification Selection Switch (SW1)	Terminating Resistor Selection Switch (SW2)	Power Specifications *2
Mitsubishi standard motor with encoder Mitsubishi high efficiency motor with encoder	SF-JR	Differential	ON	5V
	SF-HR	Differential	ON	5V
	Others	*1	*1	*1
Mitsubishi constant-torque motor with encoder	SF-JRCA	Differential	ON	5V
	SF-HRCA	Differential	ON	5V
	Others	*1	*1	*1
Vector control dedicated motor	SF-V5RU	Complimentary	OFF	12V
Other manufacturer motor with encoder	–	*1	*1	*1

*1 Set according to the motor (encoder) used.
*2 Choose a power supply (5V/12V/15V/24V) for encoder according to the encoder used.

CAUTION

SW3 switch is for manufacturer setting. Do not change the setting.

• Encoder specification

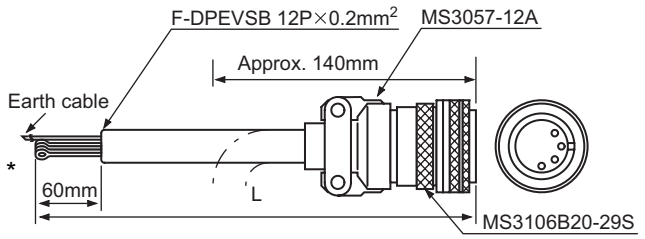
Item	Encoder for SF-JR/HR/JRCA/HRCA	Encoder for SF-V5RU
Resolution	1024 Pulse/Rev	2048 Pulse/Rev
Power supply voltage	5VDC±10%	12VDC±10%
Current consumption	150mA	150mA
Output signal form	A, B phases (90° phase shift) Z phase: 1 pulse/rev	A, B phases (90° phase shift) Z phase: 1 pulse/rev
Output circuit	Differential line driver 74LS113 equivalent	Complimentary
Output voltage	H level: 2.4V or more L level: 0.5V or less	H level: "Power supply for encoder-3V" or more L level: 3V or less

CAUTION

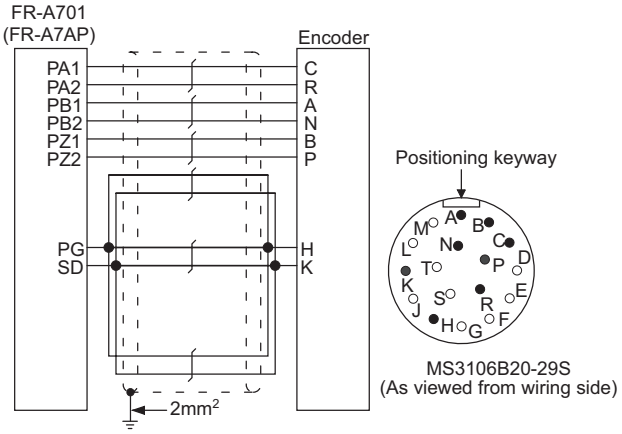
Encoder with resolution of 1000 to 4096 pulse/rev is recommended.

(4) Encoder Cable

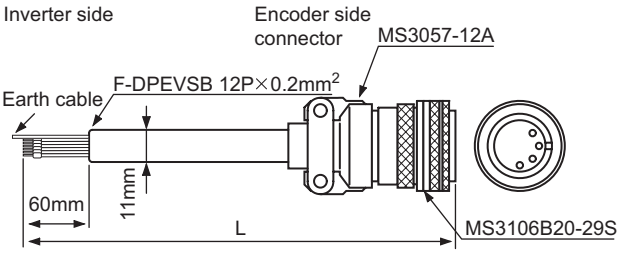
SF-JR/HR/JRCA/HRCA Motor with Encoder



Type	Length L (m)
FR-JCBL5	5
FR-JCBL15	15
FR-JCBL30	30

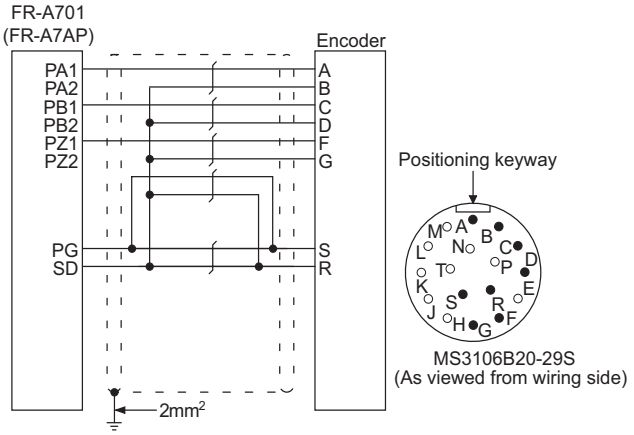


SF-V5RU, SF-THY



· A P clip for earthing (grounding) a shielded cable is provided.

Type	Length L (m)
FR-V7CBL5	5
FR-V7CBL15	15
FR-V7CBL30	30



* As the terminal block of FR-A7AP is an insertion type, earthing cables need to be modified. (See below)

- When using the dedicated encoder cable (FR-JCBL, FR-V5CBL, etc.) for the conventional motor, cut the crimpling terminal of the encoder cable and strip its sheath to make its cables loose.
  Also, protect the shielded cable of the twisted pair shielded cable to ensure that it will not make contact with the conductive area.
  Wire the stripped wire after twisting it to prevent it from becoming loose. In addition, do not solder it.

Use a blade terminal as necessary.

REMARKS

Information on blade terminals

Commercially available product examples (as of January 2010)

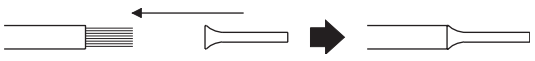
●Phoenix Contact Co.,Ltd.

Terminal Screw Size	Wire Size (mm²)	Blade Terminal Model		Blade terminal crimping tool
		with insulation sleeve	without insulation sleeve	
M2	0.3, 0.5	AI 0,5-6WH	A 0,5-6	CRIMPFOX 6

●NICHIFU Co.,Ltd.

Terminal Screw Size	Wire Size (mm²)	Blade terminal product number	Insulation product number	Blade terminal crimping tool
M2	0.3 to 0.75	BT 0.75-7	VC 0.75	NH 67

When using the blade terminal (without insulation sleeve), use care so that the twisted wires do not come out.



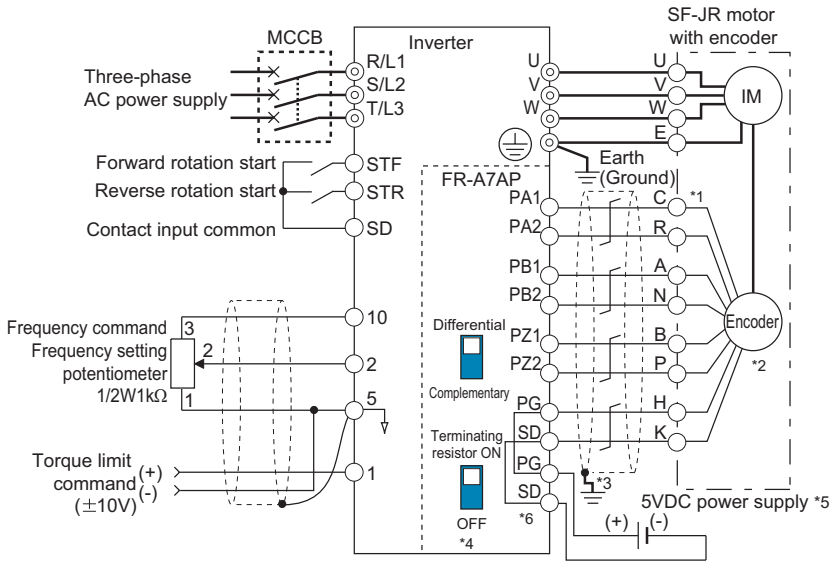
Connection terminal compatibility table

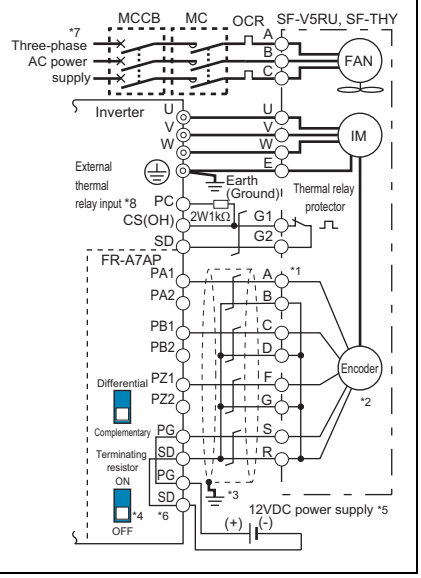
Motor		SF-V5RU, SF-THY	SF-JR/HR/JRCA/HRCA (with Encoder)
Encoder cable		FR-V7CBL	FR-JCBL
FR-A7AP terminal	PA1	PA	PA
	PA2	Keep this open.	PAR
	PB1	PB	PB
	PB2	Keep this open.	PBR
	PZ1	PZ	PZ
	PZ2	Keep this open.	PZR
	PG	PG	5E
	SD	SD	AG2

(5) Wiring

• Speed control

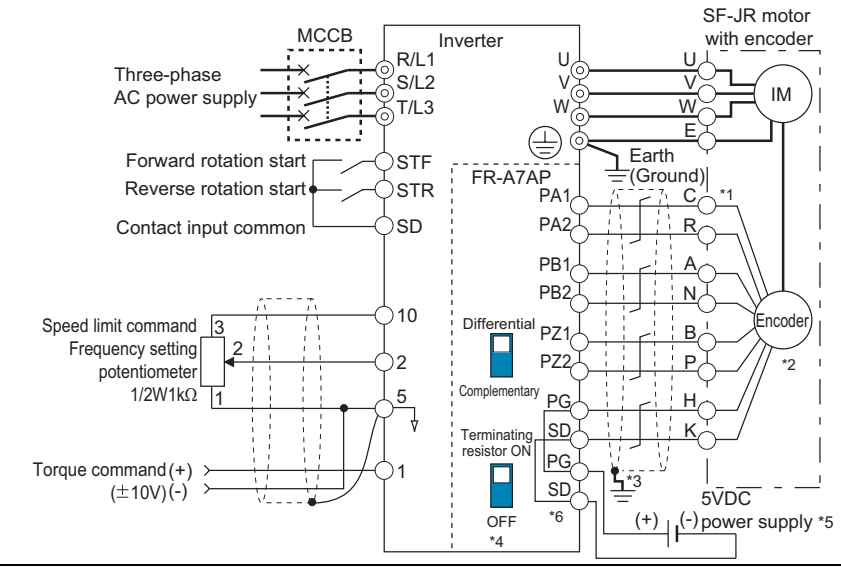
Standard motor with encoder (SF-JR), 5V differential line driver	Vector control dedicated motor (SF-V5RU, SF-THY), 12V complementary

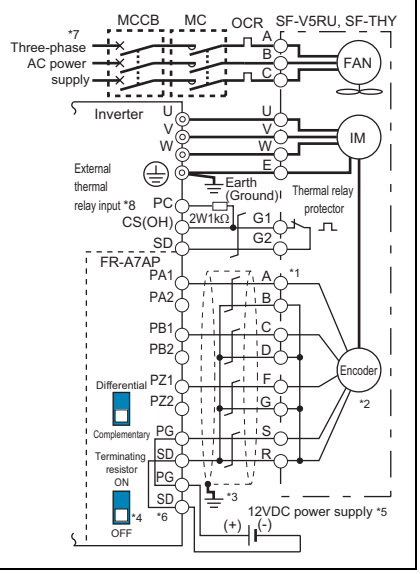




• Torque control

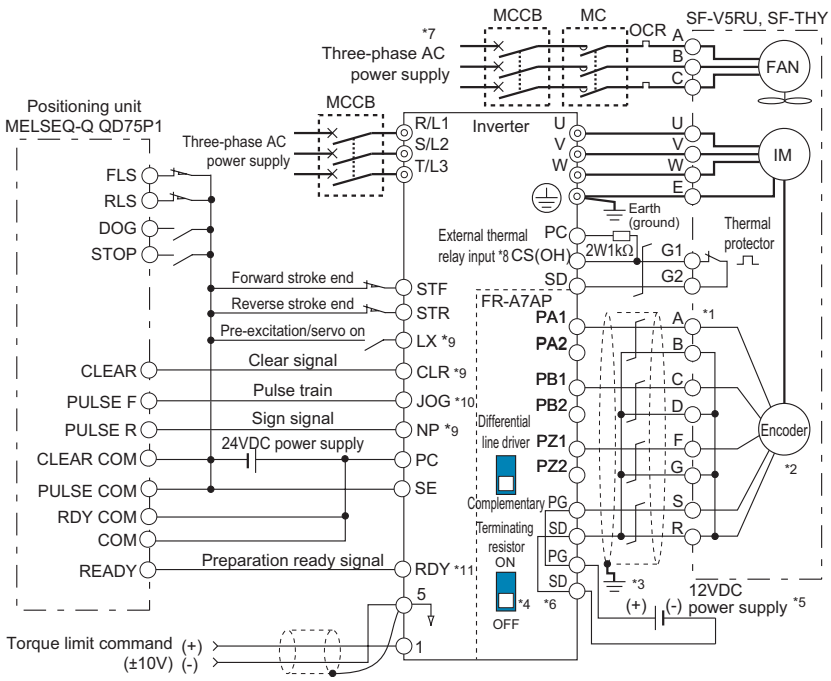
Standard motor with encoder (SF-JR), 5V differential line driver	Vector control dedicated motor (SF-V5RU, SF-THY), 12V complementary





- Position control

Vector control dedicated motor (SF-V5RU, SF-THY), 12V complementary



*1 The pin number differs according to the encoder used.
Speed control, torque control, and position control by pulse train input are properly performed without the connection of the Z-phase.

*2 Connect the encoder so that there is no looseness between the motor and motor shaft. Speed ratio should be 1:1.

*3 Earth (Ground) the shielded cable of the encoder cable to the enclosure with a P clip, etc. *(Refer to page 33.)*

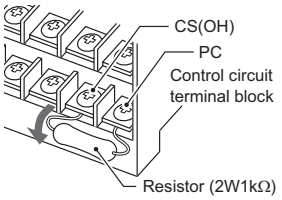
*4 For the complementary, set the terminating resistor selection switch to off position. *(Refer to page 29.)*

*5 A separate power supply of 5V/12V/15V/24V is necessary according to the encoder power specification.

*6 For terminal compatibility of the FR-JCBL, FR-V7CBL and FR-A7AP, refer to *page 31*.

*7 For the fan of the 7.5kW or less dedicated motor, the power supply is single phase. (200V/50Hz, 200 to 230V/60Hz)

*8 Assign OH (external thermal input) signal to the terminal CS. (Set "7" in *Pr. 186*)
Connect a 2W1kΩ resistor between the terminal PC and CS (OH). Install the resistor pushing against the bottom part of the terminal block so as to avoid a contact with other cables.



Refer to Chapter 4 of the Instruction Manual (Applied) for details of Pr. 186 CS terminal function selection.

*9 Assign the function using *Pr. 178 to Pr. 184, Pr. 187 to Pr. 189 (input terminal function selection)*.

*10 When position control is selected, terminal JOG function is invalid and the simple position pulse train input terminal becomes valid.

*11 Assign the function using *Pr. 190 to Pr. 194 (output terminal function selection)*.

(6) Instructions for encoder cable wiring

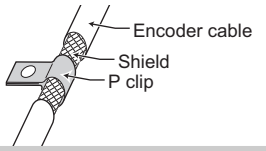
- Use twisted pair shield cables (0.2mm^2 or larger) to connect the FR-A7AP and position detector. Cables to terminals PG and SD should be connected in parallel or be larger in size according to the cable length.
  To protect the cables from noise, run them away from any source of noise (e.g. the main circuit and power supply voltage).

Wiring Length	Parallel Connection		Larger-Size Cable
Within 10m	At least two cables in parallel	Cable gauge 0.2mm^2	0.4mm^2 or larger
Within 20m	At least four cables in parallel		0.75mm^2 or larger
Within 100m *	At least six cables in parallel		1.25mm^2 or larger

* When differential line driver is set and a wiring length is 30m or more
The wiring length can be extended to 100m by slightly increasing the power by 5V (approx. 5.5V) using six or more cables with gauge size of 0.2mm^2 in parallel or a cable with gauge size of 1.25mm^2 or more. Note that the voltage applied should be within power supply specifications of encoder.

- To reduce noise of the encoder cable, earth (ground) the encoder shielded cable to the enclosure (as near as the inverter) with a P clip or U clip made of metal.

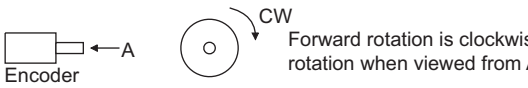
Earthing (grounding) example using a P clip



REMARKS

- For details of the optional encoder dedicated cable (FR-JCBL/FR-V7CBL), refer to *page 30*.
- The FR-V7CBL is provided with a P clip for earthing (grounding) shielded cable.

(7) Parameter for encoder *(Pr. 359, Pr. 369)*

Parameter Number	Name	Initial Value	Setting Range	Description
359	**Encoder rotation direction**	1	0	 Forward rotation is clockwise rotation when viewed from A.
			1	 Forward rotation is counterclockwise rotation when viewed from A.
369	**Number of encoder pulses**	1024	0 to 4096	Set the number of encoder pulses output. Set the number of pulses before it is multiplied by 4.

The above parameters can be set when the FR-A7AP (option) is mounted.

(8) Motor for vector control and parameter setting

Motor Name		*Pr. 9* Electronic thermal O/L relay	*Pr. 71* Applied motor	*Pr. 80* Motor capacity	*Pr. 81* Number of motor poles	*Pr. 359* Encoder rotation direction	*Pr. 369* Number of encoder pulses
Mitsubishi standard motor	SF-JR	Motor rated current	**0**	Motor capacity	Number of motor poles	**1**	**1024**
	SF-HR	Motor rated current	**40**	Motor capacity	Number of motor poles	**1**	**1024**
	Others	Motor rated current	3 *1	Motor capacity	Number of motor poles	*2	*2
Mitsubishi constant-torque motor	SF-JRCA 4P	Motor rated current	1	Motor capacity	4	**1**	**1024**
	SF-HRCA	Motor rated current	50	Motor capacity	Number of motor poles	**1**	**1024**
	Others	Motor rated current	13 *1	Motor capacity	Number of motor poles	*2	*2
Mitsubishi vector control dedicated motor	SF-V5RU (1500r/min series)	0 *3	30	Motor capacity	4	**1**	**2048**
	SF-V5RU (except for 1500r/min series)	0 *3	13 *1	Motor capacity	4	**1**	**2048**
	SF-THY	0 *3	33 *1	Motor capacity	4	**1**	**2048**
Other manufacturer's standard motor	—	Motor rated current	3 *1	Motor capacity	Number of motor poles	*2	*2
Other manufacturer's constant-torque motor	—	Motor rated current	13 *1	Motor capacity	Number of motor poles	*2	*2

Values in the bolded frame are initial values.

*1 Offline auto tuning is necessary. *(Refer to page 71)*
*2 Set this parameter according to the motor (encoder) used.
*3 Use thermal protector input provided with the motor.

♦Parameters referred to♦

- *Vector control (speed control, torque control, position control), orientation control, encoder feedback control*
  ☞Refer to Chapter 4 of the Instruction Manual (Applied).

(9) Combination with a vector control dedicated motor

Refer to the table below when using with a vector control dedicated motor.

• Combination with the SF-V5RU

Voltage	200V class			400V class		
Rated speed	1500r/min					
Base frequency	50Hz					
Maximum speed	3000r/min					
Motor capacity	Motor frame number	Motor model	Inverter model	Motor frame number	Motor model	Inverter model
3.7kW	112M	SF-V5RU3K	FR-A721-5.5K	—	—	—
5.5kW	132S	SF-V5RU5K	FR-A721-7.5K	132S	SF-V5RUH5K	FR-A741-7.5K
7.5kW	132M	SF-V5RU7K	FR-A721-11K	132M	SF-V5RUH7K	FR-A741-11K
11kW	160M	SF-V5RU11K	FR-A721-15K	160M	SF-V5RUH11K	FR-A741-15K
15kW	160L	SF-V5RU15K	FR-A721-18.5K	160L	SF-V5RUH15K	FR-A741-18.5K
18.5kW	180M	SF-V5RU18K	FR-A721-22K	180M	SF-V5RUH18K	FR-A741-22K
22kW	180M	SF-V5RU22K	FR-A721-30K	180M	SF-V5RUH22K	FR-A741-30K
30kW	200L *2	SF-V5RU30K	FR-A721-37K	200L *2	SF-V5RUH30K	FR-A741-37K
37kW	200L *2	SF-V5RU37K	FR-A721-45K	200L *2	SF-V5RUH37K	FR-A741-45K
45kW	200L *2	SF-V5RU45K	FR-A721-55K	200L *2	SF-V5RUH45K	FR-A741-55K

• Combination with the SF-V5RU1, 3, 4 and SF-THY

	SF-V5RU□1 (1:2)			SF-V5RU□3 (1:3)			SF-V5RU□4 (1:4)		
Voltage	200V class								
Rated speed	1000r/min			1000r/min			500r/min		
Base frequency	33.33Hz			33.33Hz			16.6Hz		
Maximum speed	2000r/min			3000r/min			2000r/min		
Motor capacity	Motor frame number	Motor model	Inverter model	Motor frame number	Motor model	Inverter model	Motor frame number	Motor model	Inverter model
3.7kW	132S	SF-V5RU3K1	FR-A721-5.5K	132M	SF-V5RU3K3	FR-A721-5.5K	160L	SF-V5RU3K4	FR-A721-7.5K
5.5kW	132M	SF-V5RU5K1	FR-A721-7.5K	160M	SF-V5RU5K3	FR-A721-7.5K	180L	SF-V5RU5K4	FR-A721-7.5K
7.5kW	160M	SF-V5RU7K1	FR-A721-11K	160L	SF-V5RU7K3	FR-A721-11K	200L	SF-V5RU7K4	FR-A721-11K
11kW	160L	SF-V5RU11K1	FR-A721-15K	180M	SF-V5RU11K3	FR-A721-15K	225S	SF-V5RU11K4	FR-A721-15K
15kW	180M	SF-V5RU15K1	FR-A721-18.5K	180L	SF-V5RU15K3	FR-A721-18.5K	225S	SF-V5RU15K4	FR-A721-22K
18.5kW	180L	SF-V5RU18K1	FR-A721-22K	200L	SF-V5RU18K3	FR-A721-22K	250MD	SF-THY	FR-A721-22K
22kW	200L	SF-V5RU22K1	FR-A721-30K	200L	SF-V5RU22K3	FR-A721-30K	280MD	SF-THY	FR-A721-30K
30kW	200L*3	SF-V5RU30K1	FR-A721-37K	225S*1	SF-V5RU30K3	FR-A721-37K	280MD	SF-THY	FR-A721-37K
37kW	225S	SF-V5RU37K1	FR-A721-45K	250MD*1	SF-THY	FR-A721-45K	280MD	SF-THY	FR-A721-45K
45kW	250MD	SF-THY	FR-A721-55K	250MD*1	SF-THY	FR-A721-55K	280MD	SF-THY	FR-A721-55K

Models surrounded by black borders and 400V class are developed upon receipt of order.

*1 The maximum speed is 2400r/min.

*2 80% output in the high-speed range. (The output is reduced when the speed is 2400r/min or more.)

*3 90% output in the high-speed range. (The output is reduced when the speed is 1000r/min or more.)

3 PRECAUTIONS FOR USE OF THE INVERTER

3.1 EMC and leakage currents

3.1.1 Leakage currents and countermeasures

Capacitances exist between the inverter I/O cables, other cables and earth and in the motor, through which a leakage current flows. Since its value depends on the static capacitances, carrier frequency, etc., low acoustic noise operation at the increased carrier frequency of the inverter will increase the leakage current. Therefore, take the following measures. Select the earth leakage circuit breaker according to its rated sensitivity current, independently of the carrier frequency setting.

(1) To-earth (ground) leakage currents

Leakage currents may flow not only into the inverter's own line but also into the other lines through the earth (ground) cable, etc. These leakage currents may operate earth (ground) leakage circuit breakers and earth leakage relays unnecessarily.

- Suppression technique
  - If the carrier frequency setting is high, decrease the *Pr. 72 PWM frequency selection* setting. Note that motor noise increases. Selecting *Pr. 240 Soft-PWM operation selection* makes the sound inoffensive.
  - By using earth leakage circuit breakers designed for harmonic and surge suppression in the inverter's own line and other line, operation can be performed with the carrier frequency kept high (with low noise).
- To-earth (ground) leakage currents
  - Take caution as long wiring will increase the leakage current. Decreasing the carrier frequency of the inverter reduces the leakage current.
  - Increasing the motor capacity increases the leakage current. The leakage current of the 400V class is larger than that of the 200V class.

(2) Line-to-line leakage currents

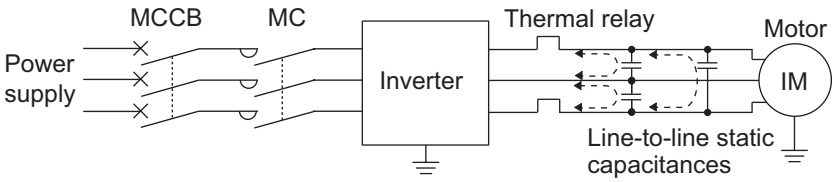
Harmonics of leakage currents flowing in static capacitances between the inverter output cables may operate the external thermal relay unnecessarily. When the wiring length is long (50m or more) for the 400V class small-capacity model (7.5K or lower), the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated motor current increases.

- Line-to-line leakage current data example (200V class)

Motor Capacity (kW)	Rated Motor Current(A)	Leakage Currents(mA)	
		Wiring length 50m	Wiring length 100m
3.7	12.8	440	630
5.5	19.4	490	680
7.5	25.6	535	725

·Motor SF-JR 4P
·Carrier frequency: 14.5kHz
·Used wire: 2mm^2, 4cores Cabtyre cable

*The leakage currents of the 400V class are about twice as large.



Line-to-line leakage currents path

- Measures
  - Use *Pr. 9 Electronic thermal O/L relay*.
  - If the carrier frequency setting is high, decrease the *Pr. 72 PWM frequency selection* setting. Note that motor noise increases. Selecting *Pr. 240 Soft-PWM operation selection* makes the sound inoffensive. To ensure that the motor is protected against line-to-line leakage currents, it is recommended to use a temperature sensor to directly detect motor temperature.
- Installation and selection of moulded case circuit breaker

  Install a moulded case circuit breaker (MCCB) on the power receiving side to protect the wiring of the inverter input side. Select the MCCB according to the inverter input side power factor (which depends on the power supply voltage, output frequency and load). Especially for a completely electromagnetic MCCB, one of a slightly large capacity must be selected since its operation characteristic varies with harmonic currents. (Check it in the data of the corresponding breaker.) As an earth leakage circuit breaker, use the Mitsubishi earth leakage circuit breaker designed for harmonics and surge suppression.

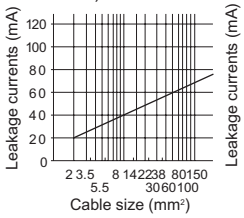
(3) Selection of rated sensitivity current of earth leakage circuit breaker

When using the earth leakage circuit breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency:

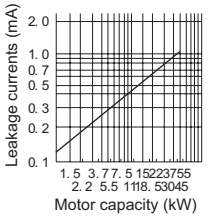
- Breaker designed for harmonic and surge suppression
  Rated sensitivity current:
  $I\Delta n \geq 10 \times (Ig1 + Ign + Igi + Ig2 + Igm)$
- Standard breaker
  Rated sensitivity current:
  $I\Delta n \geq 10 \times \{Ig1 + Ign + Igi + 3 \times (Ig2 + Igm)\}$

Ig1, Ig2: Leakage currents in wire path during commercial power supply operation
Ign: Leakage current of inverter input side noise filter
Igm: Leakage current of motor during commercial power supply operation
Igi: Leakage current of inverter unit

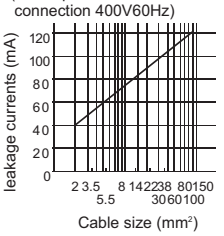
Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)



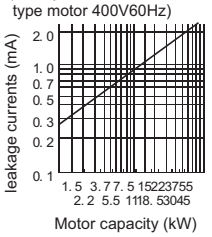
Leakage current example of three-phase induction motor during the commercial power supply operation (200V 60Hz)



Example of leakage current per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (Three-phase three-wire delta connection 400V60Hz)

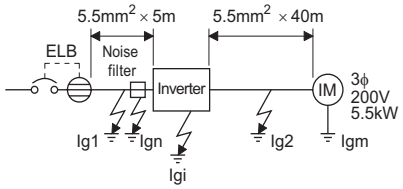


Leakage current example of three-phase induction motor during the commercial power supply operation (Totally-enclosed fan-cooled type motor 400V60Hz)



For "⅄" connection, the amount of leakage current is appox.1/3 of the above value.

<Example>



	Breaker Designed for Harmonic and Surge Suppression	Standard Breaker
Leakage current Ig1 (mA)	$33 \times \frac{5m}{1000m} = 0.17$	
Leakage current Ign (mA)	0 (without noise filter)	
Leakage current Igi (mA)	1	
Leakage current Ig2 (mA)	$33 \times \frac{40m}{1000m} = 1.32$	
Motor leakage current Igm (mA)	0.29	
Total leakage current (mA)	2.78	6.00
Rated sensitivity current (mA) (≥ Ig × 10)	30	100

CAUTION

- Install the earth leakage circuit breaker (ELB) on the input side of the inverter.
- In the ⅄ connection earthed-neutral system, the sensitivity current is blunt against an earth (ground) fault in the inverter output side. Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards)
  Use a neutral-point earthed (grounded) power supply for 400V class inverter in compliance with EN standard.
- When the breaker is installed on the output side of the inverter, it may be unnecessarily operated by harmonics even if the effective value is less than the rating. In this case, do not install the breaker since the eddy current and hysteresis loss will increase, leading to temperature rise.
- The following models are standard breakers....BV-C1, BC-V, NVB, NV-L, NV-G2N, NV-G3NA and NV-2F earth leakage relay (except NV-ZHA), NV with AA neutral wire open-phase protection
  The other models are designed for harmonic and surge suppression....NV-C/NV-S/MN series, NV30-FA, NV50-FA, BV-C2, earth leakage alarm breaker (NF-Z), NV-ZHA, NV-H

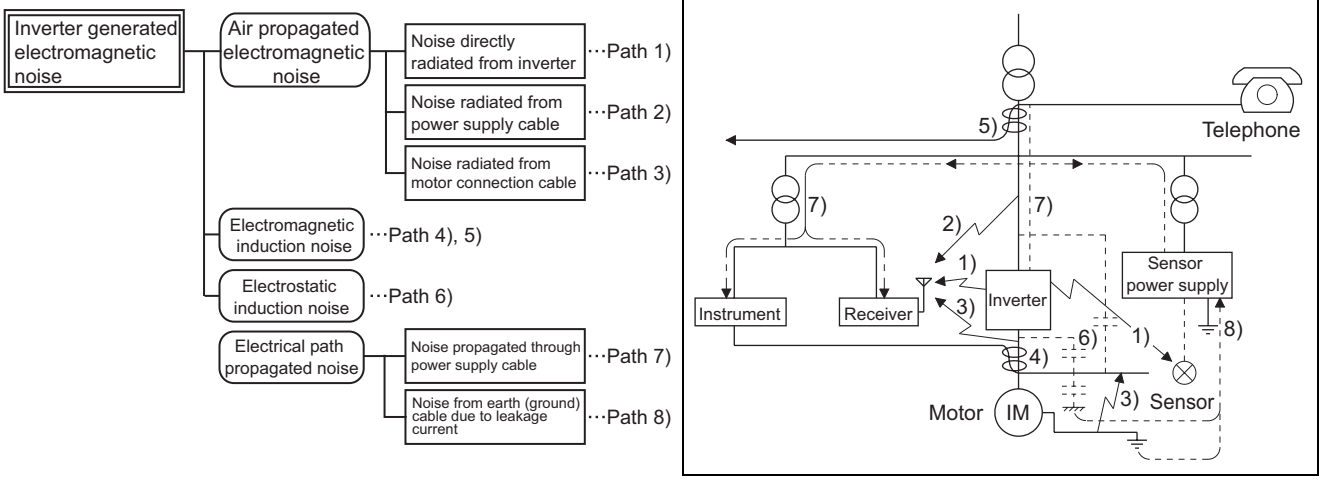
3.1.2 EMC measures

Some electromagnetic noises enter the inverter to malfunction it and others are radiated by the inverter to malfunction peripheral devices. Though the inverter is designed to have high immunity performance, it handles low-level signals, so it requires the following basic techniques. Also, since the inverter chops outputs at high carrier frequency, that could generate electromagnetic noises. If these electromagnetic noises cause peripheral devices to malfunction, EMI measures should be taken to suppress noises. These techniques differ slightly depending on EMI paths.

1) Basic techniques
- Do not run the power cables (I/O cables) and signal cables of the inverter in parallel with each other and do not bundle them.
- Use twisted shield cables for the detector connecting and control signal cables and connect the sheathes of the shield cables to terminal SD.
- Earth (Ground) the inverter, motor, etc. at one point.

2) Techniques to reduce electromagnetic noises that enter and malfunction the inverter (Immunity measures))
When devices that generate many electromagnetic noises (which use magnetic contactors, magnetic brakes, many relays, for example) are installed near the inverter and the inverter may be malfunctioned by electromagnetic noises, the following measures must be taken:
- Provide surge suppressors for devices that generate many electromagnetic noises to suppress electromagnetic noises.
- Fit data line filters (*page 38*) to signal cables.
- Earth (Ground) the shields of the detector connection and control signal cables with cable clamp metal.

3) Techniques to reduce electromagnetic noises that are radiated by the inverter to malfunction peripheral devices (EMI measures)
Inverter-generated electromagnetic noises are largely classified into those radiated by the cables connected to the inverter and inverter main circuits (I/O), those electromagnetically and electrostatically induced to the signal cables of the peripheral devices close to the main circuit power supply, and those transmitted through the power supply cables.

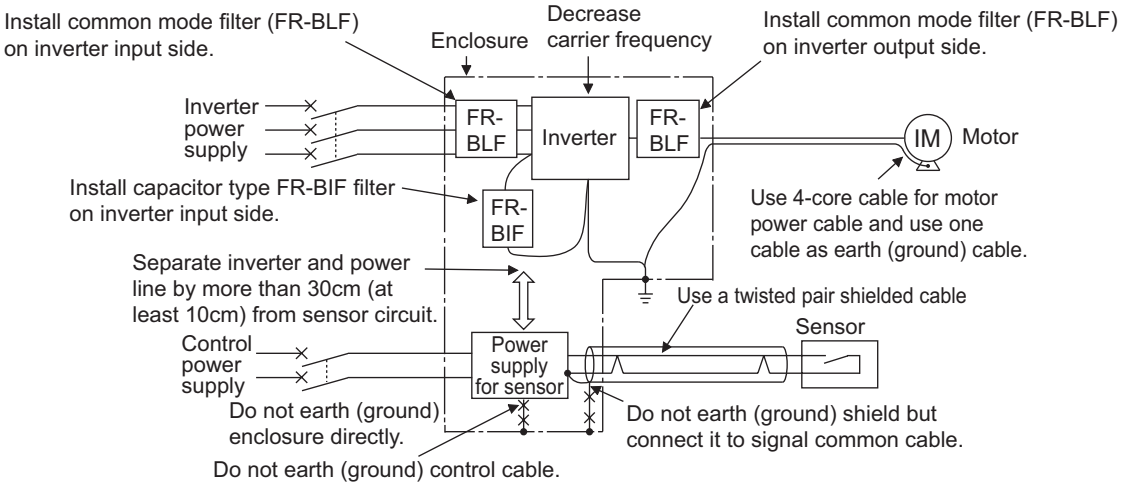


Propagation Path	Measures
1) 2) 3)	When devices that handle low-level signals and are liable to malfunction due to electromagnetic noises, e.g. instruments, receivers and sensors, are contained in the enclosure that contains the inverter or when their signal cables are run near the inverter, the devices may be malfunctioned by air-propagated electromagnetic noises. The following measures must be taken: (1) Install easily affected devices as far away as possible from the inverter. (2) Run easily affected signal cables as far away as possible from the inverter and its I/O cables. (3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. (4) Insert common mode filters into I/O and capacitors between the input lines to suppress cable-radiated noises. (5) Use shield cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
4) 5) 6)	When the signal cables are run in parallel with or bundled with the power cables, magnetic and static induction noises may be propagated to the signal cables to malfunction the devices and the following measures must be taken: (1) Install easily affected devices as far away as possible from the inverter. (2) Run easily affected signal cables as far away as possible from the I/O cables of the inverter. (3) Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them. (4) Use shield cables as signal cables and power cables and run them in individual metal conduits to produce further effects.
7)	When the power supplies of the peripheral devices are connected to the power supply of the inverter in the same line, inverter-generated noises may flow back through the power supply cables to malfunction the devices. In such a case, installing the common mode filter (FR-BLF) to the power cables (output cable) of the inverter will prevent malfunction.
8)	When a closed loop circuit is formed by connecting the peripheral device wiring to the inverter, leakage currents may flow through the earth (ground) cable of the inverter to malfunction the device. In such a case, disconnection of the earth (ground) cable of the device may cause the device to operate properly.

● **Data line filter**

Data line filter is effective as an EMC measure. Provide a data line filter for the detector cable, etc.

● **EMC measures**



3.1.3 Power supply harmonics

The inverter may generate power supply harmonics from its converter circuit to affect the power generator, power capacitor etc. Power supply harmonics are different from noise and leakage currents in source, frequency band and transmission path. Take the following countermeasure suppression techniques.
This inverter has a built-in AC reactor (FR-HAL) and a circuit type specified in Harmonic suppression guideline in Japan is three-phase bridge (capacitor smoothed) and with reactor (AC side).

3.1.4 Harmonic suppression guideline

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The harmonic suppression guideline was established to protect other consumers from these outgoing harmonic currents.
The three-phase 200V input specifications 3.7kW or less are previously covered by "Harmonic suppression guideline for household appliances and general-purpose products" and other models are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage". However, the general-purpose inverter has been excluded from the target products covered by "Harmonic suppression guideline for household appliances and general-purpose products" in January 2004. Later, this guideline was repealed on September 6, 2004. All capacities of all models are now target products of "Harmonic suppression guideline for consumers who receive high voltage or special high voltage" (hereinafter referred to as "Guideline for specific consumers").

"Guideline for specific consumers"

This guideline sets forth the maximum values of harmonic currents outgoing from a high-voltage or especially high-voltage consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.

Table 1 Maximum Values of Outgoing Harmonic Currents per 1kW Contract Power

Received Power Voltage	5th	7th	11th	13th	17th	19th	23rd	Over 23rd
6.6kV	3.5	2.5	1.6	1.3	1.0	0.9	0.76	0.70
22kV	1.8	1.3	0.82	0.69	0.53	0.47	0.39	0.36
33kV	1.2	0.86	0.55	0.46	0.35	0.32	0.26	0.24

(1) Application of the harmonic suppression guideline for specific consumers

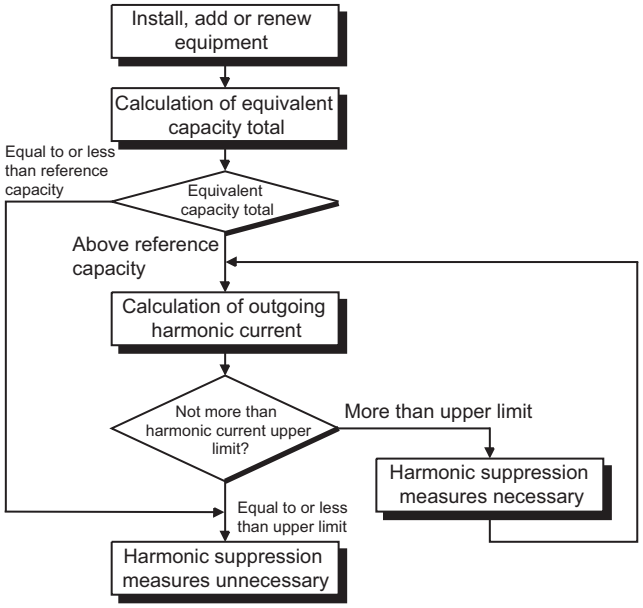


Table 2 Conversion factors for FR-A701 series

Class	Circuit Type		Conversion Factor (Ki)
3	Three-phase bridge (Capacitor smoothing)	With reactor (AC side)	K32 = 1.8

Table 3 Equivalent Capacity Limits

Received Power Voltage	Reference Capacity
6.6kV	50kVA
22/33kV	300kVA
66kV or more	2000kVA

Table 4 Harmonic content (Values of the fundamental current is 100%)

Reactor	5th	7th	11th	13th	17th	19th	23rd	25th
Used (AC side)	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3

1) Calculation of equivalent capacity P0 of harmonic generating equipment

The "equivalent capacity" is the capacity of a 6-pulse converter converted from the capacity of consumer's harmonic generating equipment and is calculated with the following equation. If the sum of equivalent capacities is higher than the limit in Table 3, harmonics must be calculated with the following procedure:

$P0 = \Sigma (Ki \times Pi)$ [kVA]

Ki: Conversion factor(According to Table 2)

Pi: Rated capacity of harmonic generating equipment* [kVA]

i : Number indicating the conversion circuit type

* Rated capacity: Determined by the capacity of the applied motor and found in Table 5. It should be noted that the rated capacity used here is used to calculate generated harmonic amount and is different from the power supply capacity required for actual inverter drive.

2) Calculation of outgoing harmonic current

Outgoing harmonic current = fundamental wave current (value converted from received power voltage) × operation ratio × harmonic content

- Operation ratio: Operation ratio = actual load factor × operation time ratio during 30 minutes
- Harmonic content: Found in Table 4.

Table 5 Rated capacities and outgoing harmonic currents of inverter-driven motors

Applied Motor (kW)	Rated Current (A)		Fundamental Wave Current Converted from 6.6kV (mA)	Rated Capacity (kVA)	Outgoing Harmonic Current Converted from 6.6kV (mA) (With reactor, 100% operation ratio)							
	200V	400V			5th	7th	11th	13th	17th	19th	23rd	25th
5.5	19.1	9.55	579	6.77	220.0	83.96	42.85	19.69	18.53	11.00	9.843	7.527
7.5	25.6	12.8	776	9.07	294.9	112.5	57.42	26.38	24.83	14.74	13.19	10.09
11	36.9	18.5	1121	13.1	426.0	162.5	82.95	38.11	35.87	21.30	19.06	14.57
15	49.8	24.9	1509	17.6	573.4	218.8	111.7	51.31	48.29	28.67	25.65	19.62
18.5	61.4	30.7	1860	21.8	706.8	269.7	137.6	63.24	59.52	35.34	31.62	24.18
22	73.1	36.6	2220	25.9	843.6	321.9	164.3	75.48	71.04	42.18	37.74	28.86
30	98.0	49.0	2970	34.7	1129	430.7	219.8	101.0	95.04	56.43	50.49	38.61
37	121	60.4	3660	42.8	1391	530.7	270.8	124.4	117.1	69.54	62.22	47.58
45	147	73.5	4450	52.1	1691	645.3	329.3	151.3	142.4	84.55	75.65	57.85
55	180	89.9	5450	63.7	2071	790.3	403.3	185.3	174.4	103.6	92.65	70.85

3) Harmonic suppression technique requirement

If the outgoing harmonic current is higher than the maximum value per 1kW (contract power) × contract power, a harmonic suppression technique is required.

4) Harmonic suppression techniques

No.	Item	Description
1	Installation of power factor improving capacitor	When used with a series reactor, the power factor improving capacitor has an effect of absorbing harmonic currents.
2	Transformer multi-phase operation	Use two transformers with a phase angle difference of 30° as in 人 - △, △ - △ combination to provide an effect corresponding to 12 pulses, reducing low-degree harmonic currents.
3	Passive filter (AC filter)	A capacitor and a reactor are used together to reduce impedances at specific frequencies, producing a great effect of absorbing harmonic currents.
4	Active filter	This filter detects the current of a circuit generating a harmonic current and generates a harmonic current equivalent to a difference between that current and a fundamental wave current to suppress a harmonic current at a detection point, providing a great effect of absorbing harmonic currents.

3.2 Power-off and magnetic contactor (MC)

(1) Inverter input side magnetic contactor (MC)

On the inverter input side, it is recommended to provide an MC for the following purposes.

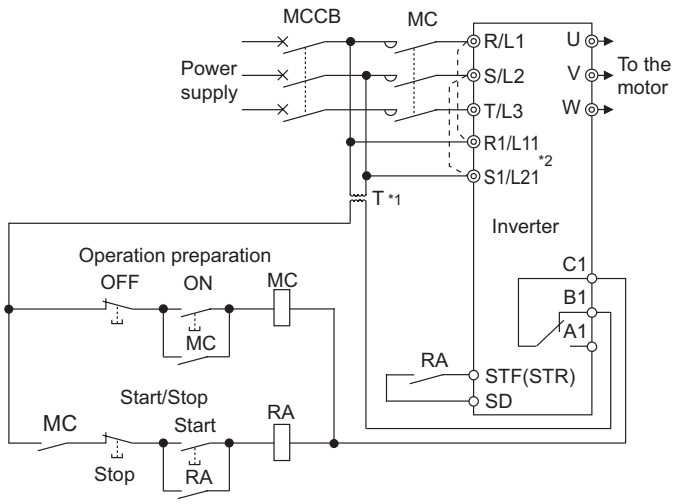
(Refer to *page 3* for selection.)

1) To release the inverter from the power supply when the fault occurs or when the drive is not functioning (e.g. emergency stop operation).
2) To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure
3) To separate the inverter from the power supply to ensure safe maintenance and inspection work

The inverter's input side MC is used for the above purpose, select class JEM1038-AC3MC for the inverter input side current when making an emergency stop during normal operation.

REMARKS

Since repeated inrush currents at power on will shorten the life of the converter circuit (switching life is about 500,000 times.), frequent starts and stops of the MC must be avoided. Turn ON/OFF the inverter start controlling terminals (STF, STR) to run/stop the inverter.



• Inverter start/stop circuit example

As shown on the left, always use the start signal (ON or OFF of STF (STR) signal) to make a start or stop.

*1 When the power supply is 400V class, install a step-down transformer.

*2 Connect the power supply terminals R1/L11, S1/L21 of the control circuit to the input side of the MC to hold an alarm signal when the inverter's protective circuit is activated. At this time, remove jumpers across terminals R/L1-R1/L11 and S/L2-S1/L21. (Refer to *page 19* for removal of the jumper.)

(2) Handling of the inverter output side magnetic contactor

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When an MC is provided to switch to a commercial power supply, for example, it is recommended to use bypass-inverter switchover function *Pr. 135 to Pr. 139 (Chapter 4 of the Instruction Manual (Applied))*.

3.3 Inverter-driven 400V class motor

In the PWM type inverter, a surge voltage attributable to wiring constants is generated at the motor terminals. Especially for a 400V class motor, the surge voltage may deteriorate the insulation. When the 400V class motor is driven by the inverter, consider the following measures:

●Measures

It is recommended to take either of the following measures:

(1) Rectifying the motor insulation and limiting the PWM carrier frequency according to the wiring length
For the 400V class motor, use an insulation-enhanced motor.
Specifically,
1)Specify the "400V class inverter-driven insulation-enhanced motor".
2)For the dedicated motor such as the constant-torque motor and low-vibration motor, use the "inverter-driven, dedicated motor".
3)Set *Pr. 72 PWM frequency selection* as indicated below according to the wiring length

	Wiring Length		
	50m or less	**50m to 100m**	**exceeding 100m**
Pr. 72 PWM frequency selection	15 (14.5kHz) or less	9 (9kHz) or less	4 (4kHz) or less

(2) Suppressing the surge voltage on the inverter side
Connect the surge voltage suppression filter (FR-ASF-H/FR-BMF-H) on the inverter output side.

CAUTION

- For explanation of surge voltage suppression filter (FR-ASF-H/FR-BMF-H), refer to the manual of each option.
- Do not perform Real sensorless vector control and vector control with a surge voltage suppression filter (FR-ASF-H) connected.
- A surge voltage suppression filter (FR-ASF-H/FR-BMF-H) can be used under V/F control and Advanced magnetic flux vector control.

3.4 Precautions for use of the inverter

The FR-A701 series is a highly reliable product, but incorrect peripheral circuit making or operation/handling method may shorten the product life or damage the product.
Before starting operation, always recheck the following items.

(1) Use crimping terminals with insulation sleeve to wire the power supply and motor.

(2) Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Never perform such wiring.

(3) After wiring, wire offcuts must not be left in the inverter.
Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the inverter.

(4) Use cables of the size to make a voltage drop 2% maximum.
If the wiring distance is long between the inverter and motor, a main circuit cable voltage drop will cause the motor torque to decrease especially at the output of a low frequency.
Refer to *page 16* for the recommended cable sizes.

(5) The overall wiring length should be within 500m with unshielded wires (within 100m for the operation under vector control or when using shielded wires).
Especially for long distance wiring, the fast-response current limit function may decrease or the equipment connected to the output side may malfunction or become faulty under the influence of a charging current due to the stray capacity of the wiring. Therefore, note the overall wiring length. *(Refer to page 18.)*

(6) Electromagnetic wave interference
The input/output (main circuit) of the inverter includes high frequency components, which may interfere with the communication devices (such as AM radios) used near the inverter. In this case, connecting a capacitor type filter will reduce electromagnetic wave interference.

(7) Do not install a power factor correction capacitor, surge suppressor or capacitor type filter on the inverter output side.
This will cause the inverter to trip or the capacitor, and surge suppressor to be damaged. If any of the above devices is installed, immediately remove it.

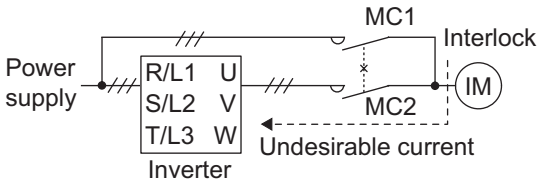
(8) For some short time after the power is switched off, a high voltage remains in the smoothing capacitor.
When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched off, and then make sure that the voltage across the main circuit terminals P/+-N/- of the inverter is not more than 30VDC using a tester, etc. The capacitor is charged with high voltage for some time after power off and it is dangerous.

(9) A short circuit or earth (ground) fault on the inverter output side may damage the inverter modules.
- Fully check the insulation resistance of the circuit prior to inverter operation since repeated short circuits caused by peripheral circuit inadequacy or an earth (ground) fault caused by wiring inadequacy or reduced motor insulation resistance may damage the inverter modules.
- Fully check the to-earth (ground) insulation and inter-phase insulation of the inverter output side before power-on. Especially for an old motor or use in hostile atmosphere, securely check the motor insulation resistance etc.

(10) Do not use the inverter input side magnetic contactor to start/stop the inverter.
Since repeated inrush currents at power ON will shorten the life of the converter circuit (switching life is about 500,000 times), frequent starts and stops of the MC must be avoided.
Always use the start signal (ON/OFF of STF and STR signals) to start/stop the inverter. *(Refer to page 12)*

(11) Do not apply a voltage higher than the permissible voltage to the inverter I/O signal circuits.
Application of permissible voltage to the inverter I/O signal circuit and incorrect polarity may damage the I/O terminal. Especially check the wiring to prevent the speed setting potentiometer from being connected incorrectly to short terminals 10E-5.

(12) Provide electrical and mechanical interlocks for MC1 and MC2 which are used for bypass operation.
When the wiring is incorrect or if there is an electronic bypass circuit as shown on the right, the inverter will be damaged by leakage current from the power supply due to arcs generated at the time of switch-over or chattering caused by a sequence error.
(Commercial operation can not be performed with the vector dedicated motor (SF-V5RU, SF-THY).)



(13) If the machine must not be restarted when power is restored after a power failure, provide a magnetic contactor in the inverter's input side and also make up a sequence which will not switch on the start signal.

If the start signal (start switch) remains on after a power failure, the inverter will automatically restart as soon as the power is restored.

(14) Inverter input side magnetic contactor (MC)

On the inverter input side, connect a MC for the following purposes. (*Refer to page* 4 for selection.)

1)To release the inverter from the power supply when a fault occurs or when the drive is not functioning (e.g. emergency stop operation). For example, MC avoids overheat or burnout of the brake resistor when heat capacity of the resistor is insufficient or brake regenerative transistor is damaged with short while connecting an optional brake resistor.

2)To prevent any accident due to an automatic restart at restoration of power after an inverter stop made by a power failure

3)To separate the inverter from the power supply to ensure safe maintenance and inspection work.

The inverter's input side MC is used for the above purpose, select class JEM1038-AC3 MC for the inverter input side current when making an emergency stop during normal operation.

(15) Handling of inverter output side magnetic contactor

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned ON while the inverter is operating, overcurrent protection of the inverter and such will activate. When MC is provided for switching to the commercial power supply, for example, switch it ON/OFF after the inverter and motor have stopped.

(16) A motor with encoder is necessary for vector control. In addition, connect the encoder directly to the backlash-free motor shaft. (An encoder is not necessary for Real sensorless vector control.)

(17) Countermeasures against inverter-generated EMI

If electromagnetic noise generated from the inverter causes frequency setting signal to fluctuate and motor rotation speed to be unstable when changing motor speed with analog signal, the following countermeasures are effective.

- Do not run the signal cables and power cables (inverter I/O cables) in parallel with each other and do not bundle them.
- Run signal cables as far away as possible from power cables (inverter I/O cables).
- Use shield cables as signal cables.
- Install a ferrite core on the signal cable (Example: ZCAT3035-1330 TDK).

(18) Instructions for overload operation

When performing an operation of frequent start/stop with the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a continuous flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Decreasing current may increase the life. However, decreasing current will result in insufficient torque and the inverter may not start. Therefore, choose the inverter which has enough allowance for current (up to 2 rank larger in capacity).

(19) Make sure that the specifications and rating match the system requirements.

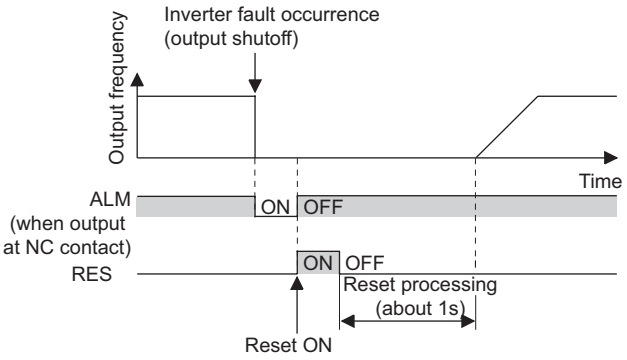
3.5 Failsafe of the system which uses the inverter

When a fault occurs, the inverter trips to output a fault signal. However, a fault output signal may not be output at an inverter fault occurrence when the detection circuit or output circuit fails, etc. Although Mitsubishi assures best quality products, provide an interlock which uses inverter status output signals to prevent accidents such as damage to machine when the inverter fails for some reason and at the same time consider the system configuration where failsafe from outside the inverter, without using the inverter, is enabled even if the inverter fails.

(1) Interlock method which uses the inverter status output signals
By combining the inverter status output signals to provide an interlock as shown below, an inverter alarm can be detected.

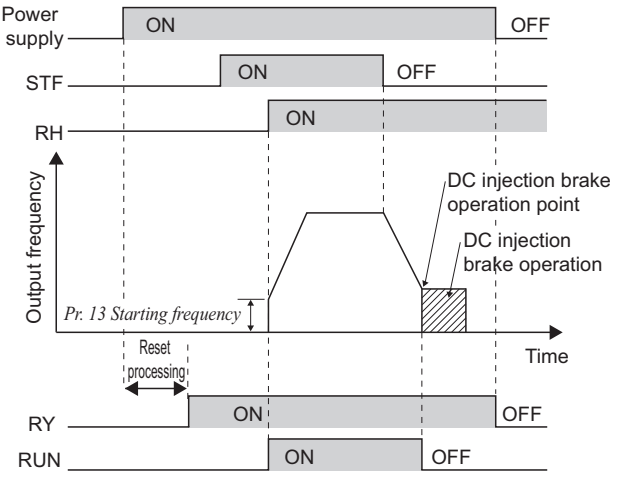
No.	Interlock Method	Check Method	Used Signals	Refer to Page
1)	Inverter protective function operation	Operation check of an alarm contact Circuit error detection by negative logic	Fault output signal (ALM signal)	*Refer to Chapter 4 of the Instruction Manual (Applied)*
2)	Inverter running status	Operation ready signal check	Operation ready signal (RY signal)	*Refer to Chapter 4 of the Instruction Manual (Applied)*
3)	Inverter running status	Logic check of the start signal and running signal	Start signal (STF signal, STR signal) Running signal (RUN signal)	*Refer to Chapter 4 of the Instruction Manual (Applied)*
4)	Inverter running status	Logic check of the start signal and output current	Start signal (STF signal, STR signal) Output current detection signal (Y12 signal)	*Refer to Chapter 4 of the Instruction Manual (Applied)*

1) Check by the output of the inverter fault signal
When the fault occurs and trips the inverter, the fault output signal (ALM signal) is output (ALM signal is assigned to terminal A1B1C1 in the initial setting).
Check that the inverter functions properly.
In addition, negative logic can be set (on when the inverter is normal, off when the fault occurs).



2) Checking the inverter operating status by the inverter operation ready completion signal
Operation ready signal (RY signal) is output when the inverter power is ON and the inverter becomes operative.
Check if the RY signal is output after powering on the inverter.

3) Checking the inverter operating status by the start signal input to the inverter and inverter running signal.
The inverter running signal (RUN signal) is output when the inverter is running (RUN signal is assigned to terminal RUN in the initial setting).
Check if RUN signal is output when inputting the start signal to the inverter (forward signal is STF signal and reverse signal is STR signal). For logic check, note that RUN signal is output for the period from the inverter decelerates until output to the motor is stopped, configure a sequence considering the inverter deceleration time



4) Checking the motor operating status by the start signal input to the inverter and inverter output current detection signal.

The output current detection signal (Y12 signal) is output when the inverter operates and currents flows in the motor. Check if Y12 signal is output when inputting the start signal to the inverter (forward signal is STF signal and reverse signal is STR signal). Note that the current level at which Y12 signal is output is set to 150% of the inverter rated current in the initial setting, it is necessary to adjust the level to around 20% using no load current of the motor as reference with *Pr. 150 Output current detection level*.

For logic check, as same as the inverter running signal (RUN signal), the inverter outputs for the period from the inverter decelerates until output to the motor is stopped, configure a sequence considering the inverter deceleration time.

Output Signal	*Pr. 190 to Pr. 196* Setting	
	Positive logic	Negative logic
ALM	99	199
RY	11	111
RUN	0	100
Y12	12	112

- When using various signals, assign functions to *Pr.190* to *Pr. 196 (output terminal function selection)* referring to the table on the left.

CAUTION

- Changing the terminal assignment using *Pr. 190 to Pr. 196 (output terminal function selection)* may affect the other functions. Set parameters after confirming the function of each terminal.

(2) Backup method outside the inverter

Even if the interlock is provided by the inverter status signal, enough failsafe is not ensured depending on the failure status of the inverter itself. For example, when the inverter CPU fails, even if the interlock is provided using the inverter fault output signal, start signal and RUN signal output, there is a case where a fault output signal is not output and RUN signal is kept output even if an inverter fault occurs.

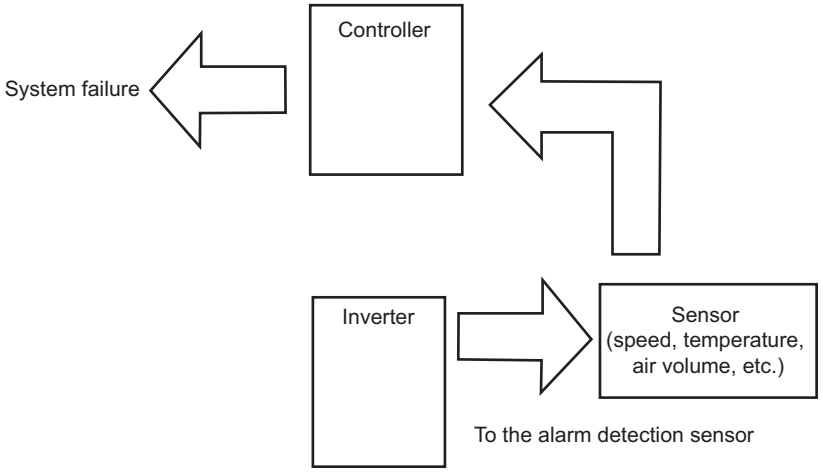
Provide a speed detector to detect the motor speed and current detector to detect the motor current and consider the backup system such as checking up as below according to the level of importance of the system.

1) Start signal and actual operation check

Check the motor running and motor current while the start signal is input to the inverter by comparing the start signal to the inverter and detected speed of the speed detector or detected current of the current detector. Note that the motor current runs as the motor is running for the period until the motor stops since the inverter starts decelerating even if the start signal turns OFF. For the logic check, configure a sequence considering the inverter deceleration time. In addition, it is recommended to check the three-phase current when using the current detector.

2) Command speed and actual operation check

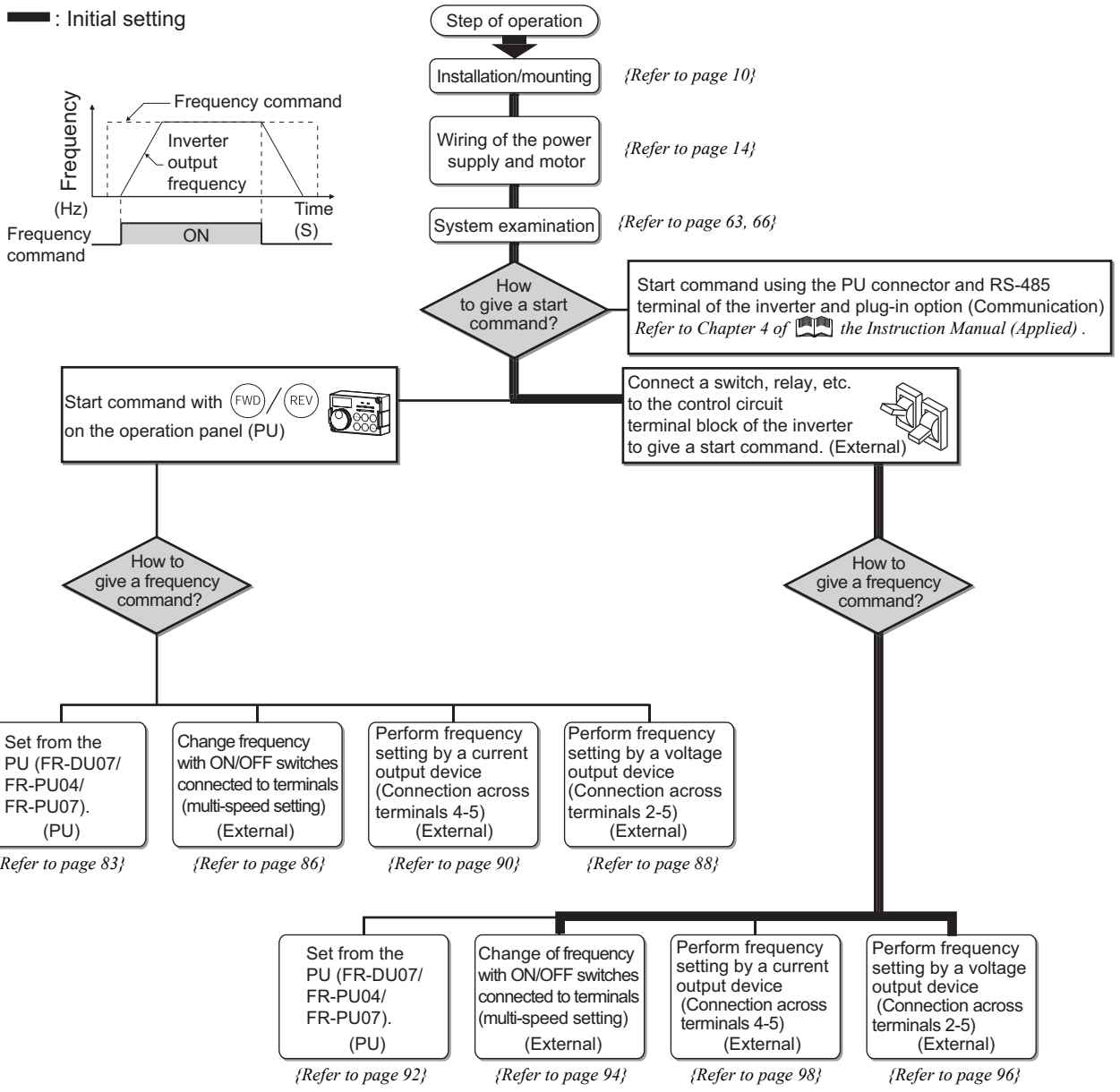
Check if there is no gap between the actual speed and commanded speed by comparing the inverter speed command and detected speed of the speed detector.



4 DRIVING THE MOTOR

4.1 Step of operation

The inverter needs frequency command and start command. Frequency command (set frequency) determines the rotation speed of the motor. Turning ON the start command starts the motor to rotate.
Refer to the flow chart below to perform setting.



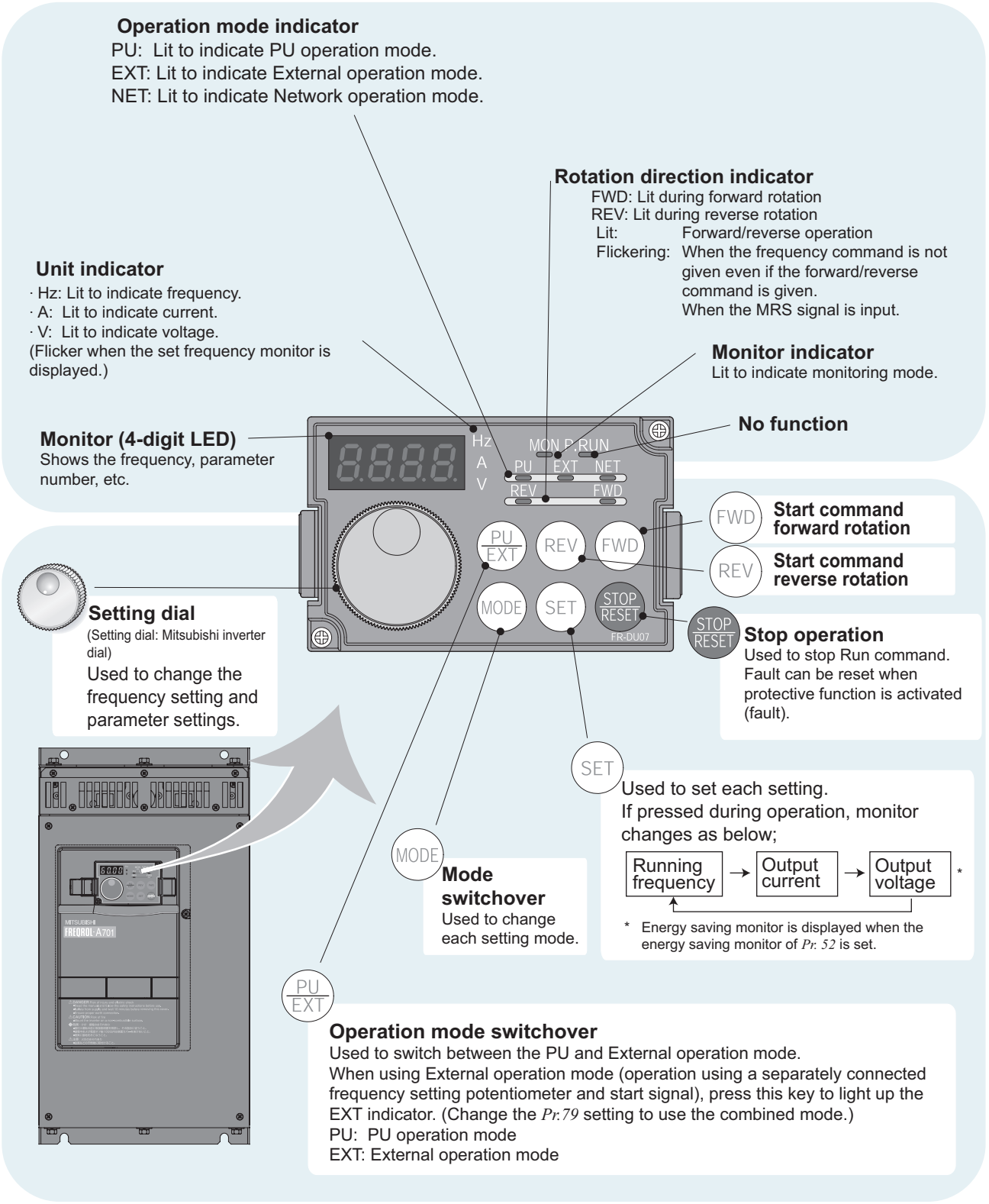
CAUTION

Check the following items before powering ON the inverter.
- Check that the inverter is installed correctly in a correct place. *(Refer to page 10)*
- Check that wiring is correct. *(Refer to page 12)*
- Check that no load is connected to the motor.

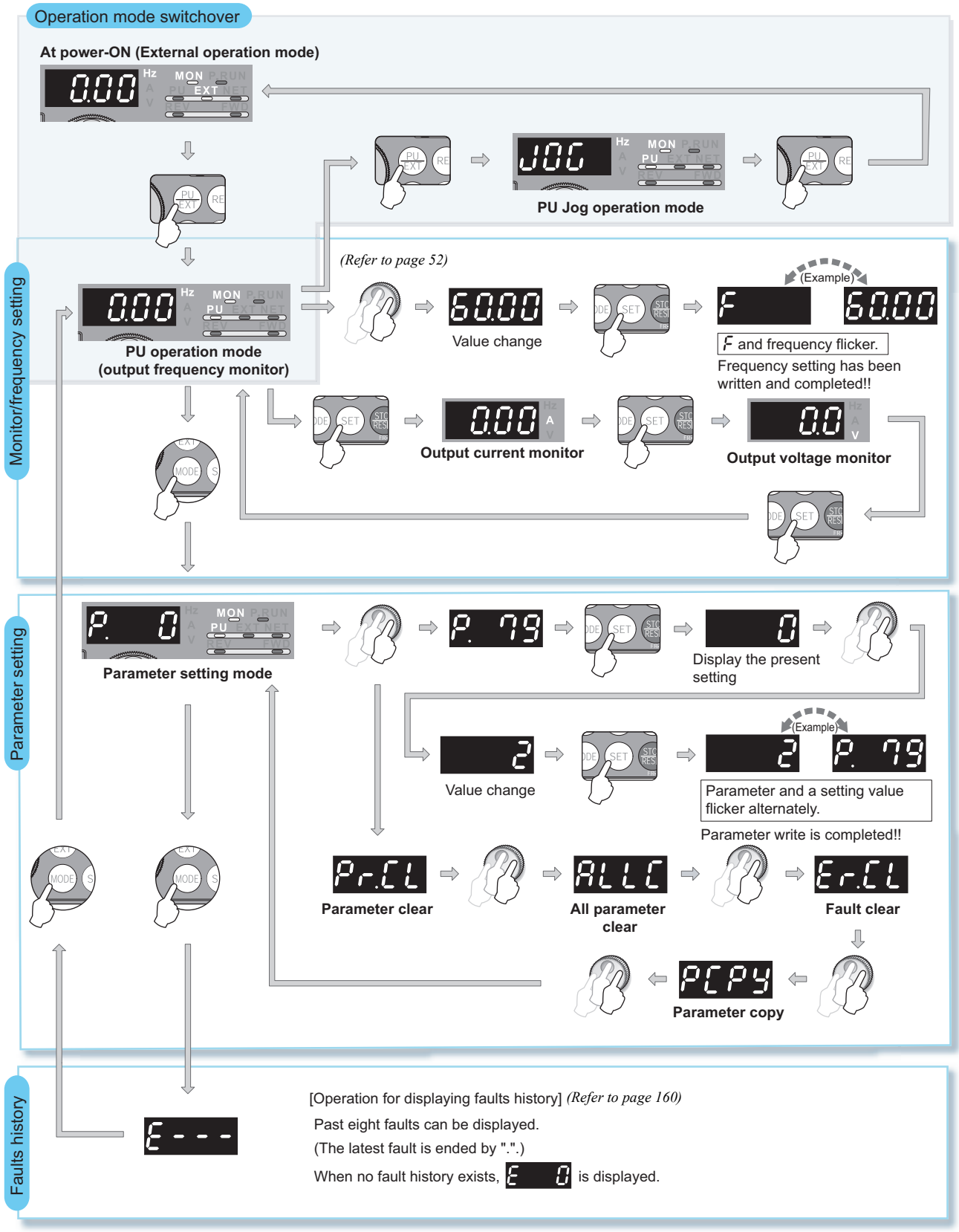
- *When protecting the motor from overheat by the inverter, set Pr.9 Electronic thermal O/L relay (Refer to page 57)*
- *When the rated frequency of the motor is 50Hz, set Pr.3 Base frequency (Refer to page 58)*

4.2 Operation panel (FR-DU07)

4.2.1 Parts of the operation panel (FR-DU07)



4.2.2 Basic operation (factory setting)



4.2.3 Operation lock (Press [MODE] for an extended time (2s))

Operation using the setting dial and key of the operation panel can be invalid to prevent parameter change, and unexpected start or frequency setting.

- Set "10 or 11" in *Pr. 161*, then press (MODE) for 2s to make the setting dial and key operation invalid.
- When the setting dial and key operation are invalid, HOLd appears on the operation panel.

  If dial and key operation is attempted while dial and key operation are invalid, HOLd appears. (When dial or key is not touched for 2s, the monitor display appears.)
- To make the setting dial and key operation valid again, press (MODE) for 2s.

POINT

Set "10 or 11" (key lock valid) in *Pr.161 Frequency setting/key lock operation selection*.

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press (PU/EXT) to choose the PU operation mode.	PU indicator is lit. (PU/EXT) ⇨ 
3. Press (MODE) to choose the parameter setting mode.	(MODE) ⇨ P. 0 (The parameter number read previously appears.)
4. Turn dial until P. 161 (*Pr. 161*) appears.	
5. Press (SET) to read the currently set value. "0" (initial value) appears.	(SET) ⇨ 0
6. Turn dial to change it to the setting value "10".	
7. Press (SET) to set.	(SET) ⇨ 10 ⇔ P. 161 **Flicker ··· Parameter setting complete!!**
8. Press (MODE) for 2s to show the key lock.	(MODE) ⇨  Press for 2s.

Functions valid even in the operation lock status

Stop and reset with (STOP/RESET).

CAUTION

Release the operation lock to release the PU stop by key operation.

4.2.4 Monitoring of output current and output voltage

POINT

Monitor display of output frequency, output current, and output voltage can be changed by pushing (SET) during monitoring mode.

Operation — Display

1. Press (MODE) during operation to choose the output frequency monitor

2. Independently of whether the inverter is running in any operation mode or at a stop, the output current monitor appears by pressing (SET).

(SET) ⇨

3. Press (SET) to show the output voltage monitor.

(SET) ⇨

4.2.5 First priority monitor

Hold down (SET) for 1s to set monitor description to be appeared first in the monitor mode.

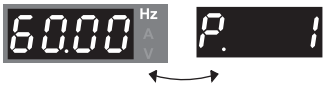
(To return to the output frequency monitor, hold down (SET) for 1s after displaying the output frequency monitor.)

4.2.6 Setting dial push

Push the setting dial () to display the set frequency currently set.

4.2.7 Changing the parameter setting value

Changing example | Change the *Pr. 1 Maximum frequency* .

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press PU/EXT to choose the PU operation mode.	PU indicator is lit. 
3. Press MODE to choose the parameter setting mode.	 The parameter number read previously appears.
4. Turn dial until P. 1 (*Pr. 1*) appears.	
5. Press SET to read the currently set value. " 120.0"(initial value) appears.	
6. Turn dial to change it to the set value "60.00".	
7. Press SET to set.	

Flicker ··· Parameter setting complete!!

· By turning dial, you can read another parameter.
· Press SET to show the setting again.
· Press SET twice to show the next parameter.
· Press MODE twice to return the monitor to frequency monitor.

? Er 1 to Er 4 are displayed ... Why?

☞ Er 1 appears. ..... Write disable error
Er2 appears. ..... Write error during operation
Er 3 appears. ..... Calibration error
Er 4 appears. ..... Mode designation error

For details refer to *page 143*.

REMARKS

The number of digits displayed on the operation panel (FR-DU07) is four.
If the values to be displayed have five digits or more including decimal places, the fifth or later numerals can not be displayed nor set.

(Example) When *Pr. 1*
When 60Hz is set, 60.00 is displayed.
When 120Hz is set, 120.0 is displayed and second decimal place is not displayed nor set.

4.2.8 Parameter clear, all parameter clear

POINT

- Set "1" in *Pr. CL parameter clear or ALLC all parameter clear* to initialize all parameters. (Parameters are not cleared when "1" is set in *Pr. 77 Parameter write selection*.)
- Refer to the parameter list on *page 103* and later for parameters to be cleared with this operation.

Operation		Display
1. Screen at power-ON The monitor display appears.		
2. Press (PU/EXT) to choose the PU operation mode.	(PU/EXT) ⇨	PU indicator is lit. 
3. Press (MODE) to choose the parameter setting mode.	(MODE) ⇨	 (The parameter number read previously appears.)
4. Turn dial until "Pr.CL", "ALLC" appears.	dial ⇨	 Parameter clear All parameter clear
5. Press (SET) to read the currently set value. "0"(initial value) appears.	(SET) ⇨	
6. Turn dial clockwise to change it to the setting value of "1".	dial ⇨	
7. Press (SET) to set.	(SET) ⇨	 Parameter clear All parameter clear **Flicker ··· Parameter setting complete!!**

- Turn dial to read another parameter.
- Press (SET) to show the setting again.
- Press (SET) twice to show the next parameter.

?  and  are displayed alternately ... Why?

☞ The inverter is not in PU operation mode.

1. Press (PU/EXT).

    is lit and the monitor (4-digit LED) displays "0" (*Pr. 79* = "0" (initial value)).
2. Carry out operation from step 6 again.

4.2.9 Parameter copy and parameter verification

PCPY Setting	Description
0	Cancel
1	Copy the source parameters to the operation panel.
2	Write the parameters copied to the operation panel into the destination inverter.
3	Verify parameters in the inverter and operation panel. *(Refer to page 55.)*

REMARKS

- When the copy destination inverter is not the FR-A701 series or parameter copy write is performed after parameter copy read is stopped, "model error (rE4)" is displayed.
- Refer to the parameter list on *page 103* and later for availability of parameter copy.
- When the power is turned OFF or an operation panel is disconnected, etc. during parameter copy write, perform write again or check the values by parameter verification.
- Initial settings of certain parameters are different for different capacities, so some parameter settings may be automatically changed when parameter copy is performed from a different-capacity inverter. After performing a parameter copy from a different-capacity inverter, check the parameter settings. (Refer to the parameter list (*page 103*) for the parameters with different initial settings for different capacities.)

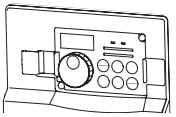
(1) Parameter copy

Parameter settings can be copied to multiple inverters.

Operation

1. Connect the operation panel to the copy source inverter.
   - **Connect it during a stop.**
2. Press (MODE) to choose the parameter setting mode.
3. Turn dial until PCPY (parameter copy) appears.
4. Press (SET) to read the currently set value. "0"(initial value) appears.
5. Turn dial to change it to the setting value "1".
6. Press (SET) to copy the source parameters to the operation panel.
7. Connect the operation panel to the copy source inverter.
8. After performing steps 2 to 5, turn dial to change it to "2".
9. Press (SET) to write the parameters copied to the operation panel to the destination inverter.
10. When copy is completed, "2" and "PCPY" flicker.
11. After writing the parameter values to the copy destination inverter, always reset the inverter, e.g. switch power OFF once, before starting operation.

Display



(MODE) → P. 0 (The parameter number previously read appears.)

dial → PCPY

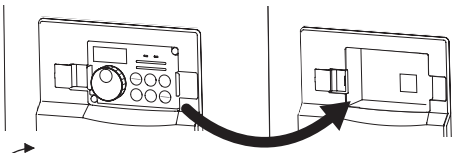
(SET) → 0

dial → 1

(SET) → 1 (Flickers for about 30s)

About 30s later → 1 PCPY

Flicker ··· Parameter copy complete!!



dial → 2

(SET) → 2 (The frequency flickers for about 30s)

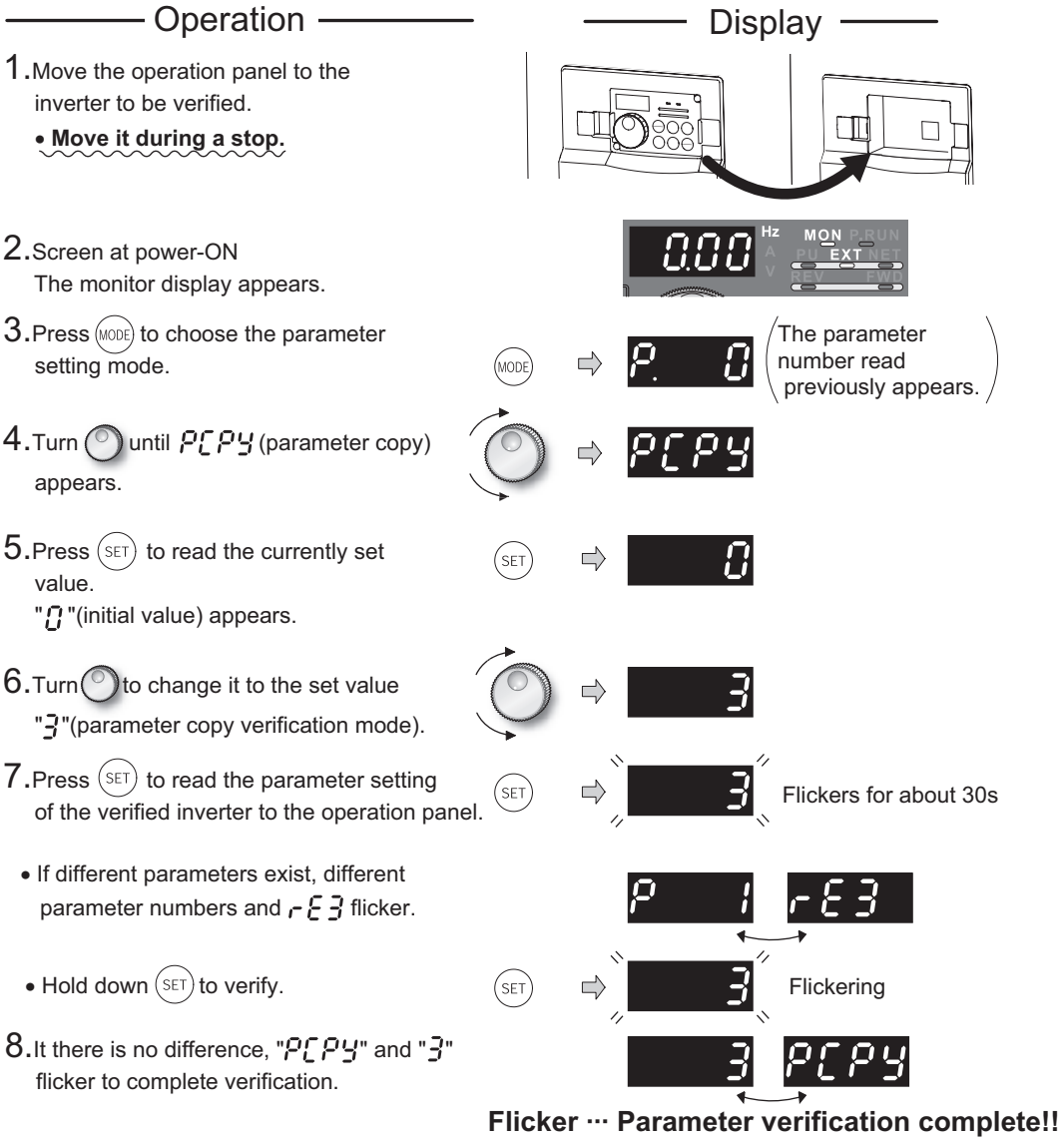
2 PCPY

Flicker ··· Parameter copy complete!!

? rE1 appears...Why? ☞ Parameter read error. Perform operation from step 3 again.
? rE2 appears...Why? ☞ Parameter write error. Perform operation from step 8 again.

(2) Parameter verification

Whether same parameter values are set in other inverters or not can be checked.



? rE3 flickers ... Why?
☞ Set frequencies, etc. may be different. Check set frequencies.

4.3 Before operation

4.3.1 Simple mode parameter list

For simple variable-speed operation of the inverter, the initial setting of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be made from the operation panel (FR-DU07). For details of parameters, refer to *Chapter 4 of the Instruction Manual (Applied)*.

POINT

Only simple mode parameter can be displayed using *Pr.160 User group read selection*. (All parameters are displayed with the initial setting.) Set *Pr. 160 User group read selection* as required. (Refer to *page 52* for parameter change.)

Pr. 160	Description
9999	Only the simple mode parameters can be displayed.
0 (Initial Value)	Simple mode and extended mode parameters can be displayed.
1	Only the parameters registered in the user group can be displayed.

Parameter Number	Name	Increments	Initial Value	Range	Applications	Refer to Page
0	Torque boost	0.1%	3/2%*1	0 to 30%	Set to increase a starting torque or when the motor with a load will not rotate, resulting in an alarm [OL] and a trip [OC1] *1 The initial value differs according to the inverter capacity. (7.5K or lower/11K or higher)	59
1	Maximum frequency	0.01Hz	120Hz	0 to 120Hz	Set when the maximum output frequency need to be limited.	60
2	Minimum frequency	0.01Hz	0Hz	0 to 120Hz	Set when the minimum output frequency need to be limited.	60
3	Base frequency	0.01Hz	60Hz	0 to 400Hz	Set when the rated motor frequency is 50Hz. Check the motor rating plate.	58
4	Multi-speed setting (high speed)	0.01Hz	60Hz	0 to 400Hz	Set when changing the preset speed in the parameter with a terminal.	94
5	Multi-speed setting (middle speed)	0.01Hz	30Hz	0 to 400Hz		
6	Multi-speed setting (low speed)	0.01Hz	10Hz	0 to 400Hz		
7	Acceleration time	0.1s	5/15s*2	0 to 3600s	Acceleration/deceleration time can be set. *2 The initial value differs according to the inverter capacity. (7.5K or lower/11K or higher)	61
8	Deceleration time	0.1s	5/15s*2	0 to 3600s		
9	Electronic thermal O/L relay	0.01A	Inverter rated current	0 to 500A	Protect the motor from overheat by the inverter. Set the rated motor current.	57
79	Operation mode selection	1	0	0, 1, 2, 3, 4, 6, 7	Select the operation command location and frequency command location.	62
125	Terminal 2 frequency setting gain frequency	0.01Hz	60Hz	0 to 400Hz	Frequency for the maximum value of the potentiometer (5V initial value) can be changed.	97
126	Terminal 4 frequency setting gain frequency	0.01Hz	60Hz	0 to 400Hz	Frequency for the maximum current input (20mA initial value) can be changed.	99
160	User group read selection	1	0	0, 1, 9999	Parameter which can be read from the operation panel and parameter unit can be restricted.	—

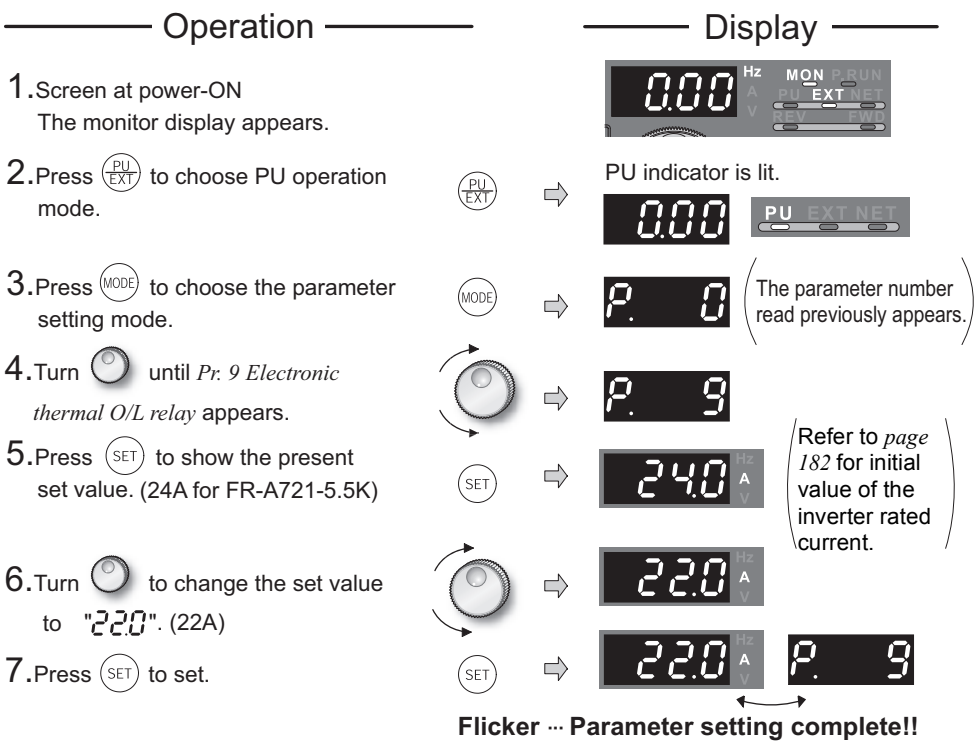
4.3.2 Overheat protection of the motor by the inverter (Pr. 9)

Set the rated motor current in *Pr. 9 Electronic thermal O/L relay* to protect the motor from overheat.

Parameter Number	Name	Initial Value	Setting Range *2	Description
9	**Electronic thermal O/L relay**	Inverter rated current *1	0 to 500A	Set the rated motor current.

*1 Refer to *page 182* for the rated inverter current value.
*2 The minimum setting increments are 0.01A.

Changing example — Change the *Pr. 9 Electronic thermal O/L relay* setting to 22A according to the motor rated current. (FR-A721-5.5K)



· By turning , you can read another parameter.
· Press SET to show the setting again.
· Press SET twice to show the next parameter.

REMARKS

· Since a thermal protector is provided for a vector control dedicated motor (SF-V5RU), set "0" in *Pr. 9*.

CAUTION

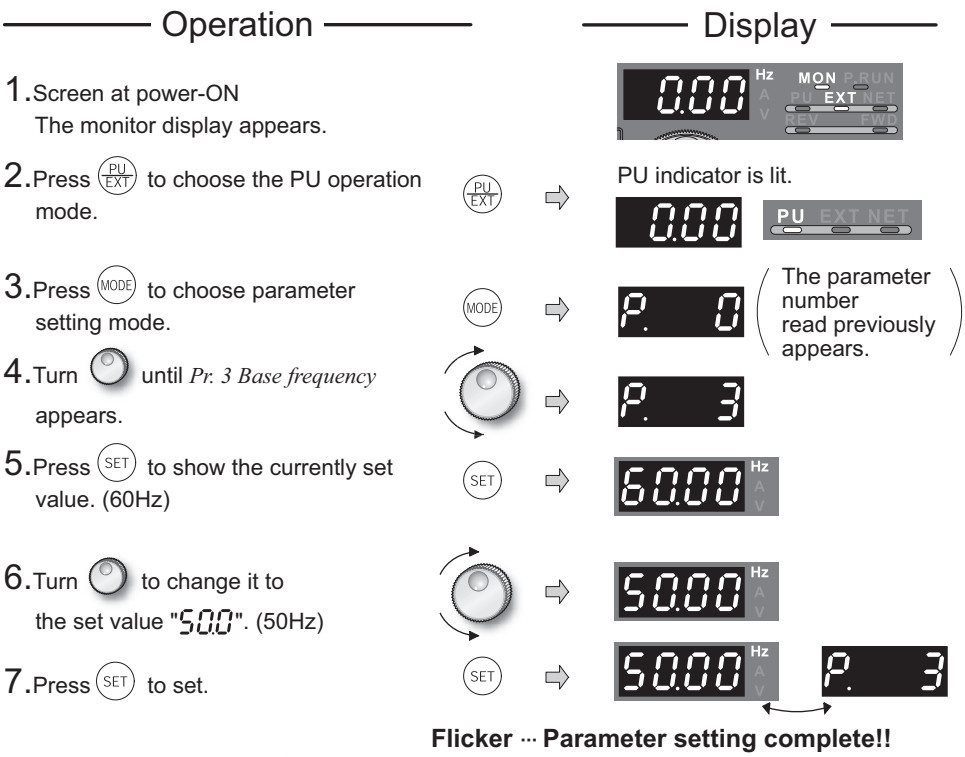
· Protective function by electronic thermal relay function is reset by inverter power reset and reset signal input. Avoid unnecessary reset and power-OFF.
· When two or more motors are connected to the inverter, they cannot be protected by the electronic thermal relay function. Install an external thermal relay to each motor.
· When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
· A special motor cannot be protected by the electronic thermal relay function. Use an external thermal relay.
· PTC thermistor output built-in the motor can be input to the PTC signal (AU terminal). For details, refer to *Chapter 4 of the Instruction Manual (Applied)*.

4.3.3 When the rated motor frequency is 50Hz (Pr. 3) V/F

First, check the motor rating plate. If a frequency given on the rating plate is "50Hz" only, always set *Pr. 3 Base frequency* to "50Hz". Leaving the base frequency unchanged from "60Hz" may make the voltage low and the torque insufficient. It may result in an inverter trip (E.OC☐) due to overload.

Parameter Number	Name	Initial Value	Setting Range	Description
3	**Base frequency**	60Hz	0 to 400Hz	Set the frequency when the motor rated torque is generated.

Changing example Change *Pr. 3 Base frequency* to 50Hz according to the motor rated frequency.



· By turning , you can read another parameter.

· Press SET to show the setting again.

· Press SET twice to show the next parameter.

REMARKS

· *Pr. 3* is invalid and *Pr.84 Rated motor frequency* is valid under Advanced magnetic flux vector control, Real sensorless vector control, and vector control.

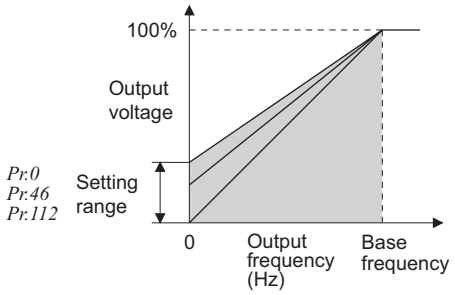
4.3.4 Increase the starting torque (Pr. 0) V/F

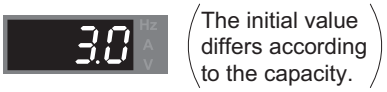
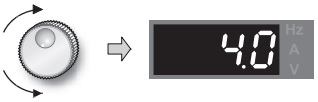
Set this parameter when "the motor with a load will not rotate", "an alarm [OL] is output, resulting in an inverter trip due to [OC1], etc.

Parameter Number	Name	Initial Value		Setting Range	Description
0	Torque boost	7.5K or lower	3%	0 to 30%	Motor torque in the low-frequency range can be adjusted to the load to increase the starting motor torque.
		11K or higher	2%		

Changing example

When the motor with a load will not rotate, increase the *Pr. 0* value 1% by 1% unit by looking at the motor movement. (The guideline is for about 10% change at the greatest.)



Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press PU/EXT to choose PU operation mode.	PU indicator is lit. 
3. Press MODE to choose the parameter setting mode.	 (The parameter number read previously appears.)
4. Turn the dial until P. 0 (*Pr. 0*) appears.	
5. Press SET to read the currently set value. "3.0"(initial value is 3% for the 5.5K) appears.	 (The initial value differs according to the capacity.)
6. Turn the dial to change it to the set value "4.0".	
7. Press SET to set.	

Flicker ··· Parameter setting complete!!

· By turning the dial, you can read another parameter.

· Press SET to show the setting again.

· Press SET twice to show the next parameter.

REMARKS

· A too large setting may cause the motor to overheat, resulting in an overcurrent trip (OL (overcurrent alarm) then E.OC1 (overcurrent trip during acceleration)), overload trip (E.THM (motor overload trip), and E.THT (inverter overload trip)). (When a fault occurs, release the start command, and decrease the *Pr. 0* setting 1% by 1% to reset.)

POINT

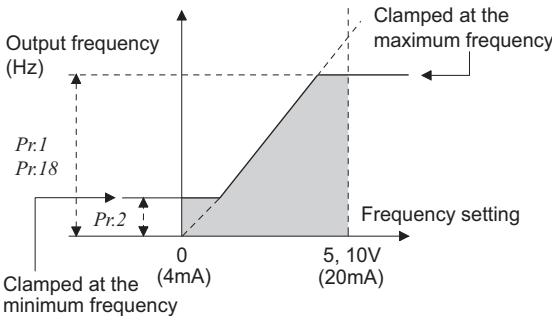
If the inverter still does not operate properly after the above measures, adjust *Pr. 80*, *Pr. 81* (Advanced magnetic flux vector control), *Pr.800* (Real sensorless vector control). The *Pr.0* setting is invalid under Advanced magnetic flux vector control, Real sensorless vector control and vector control. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

4.3.5 Limit the maximum and minimum output frequency (Pr. 1, Pr. 2)

Motor speed can be limited.

Parameter Number	Name	Initial Value	Setting Range	Description
1	**Maximum frequency**	120Hz	0 to 120Hz	Set the upper limit of the output frequency.
2	**Minimum frequency**	0Hz	0 to 120Hz	Set the lower limit of the output frequency.

Changing example Limit the frequency set by the potentiometer, etc. to 60Hz maximum.
(Set "60"Hz in *Pr. 1 Maximum frequency*.)



Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press PU/EXT to choose the PU operation mode.	PU indicator is lit. 
3. Press MODE to choose the parameter setting mode.	 (The parameter number read previously appears.)
4. Turn the dial until P. 1 (*Pr. 1*) appears.	
5. Press SET to read the currently set value. " 120.0"(initial value) appears.	
6. Turn the dial to change it to the set value "60.00".	
7. Press SET to set.	

Flicker ··· Parameter setting complete!!

· By turning the dial, you can read another parameter.
· Press SET to show the setting again.
· Press SET twice to show the next parameter.

REMARKS

· The output frequency is clamped by the *Pr. 2* setting even if the set frequency is lower than the *Pr. 2* setting (The frequency will not decrease to the *Pr. 2* setting.)
Note that *Pr. 15 Jog frequency* has higher priority than the minimum frequency.
· When the *Pr. 1* setting is changed, frequency higher than the *Pr. 1* setting can not be set by the dial.
· When performing a high speed operation at 120Hz or more, setting of *Pr. 18 High speed maximum frequency* is necessary.
(Refer to Chapter 4 of the Instruction Manual (Applied).)

⚠ CAUTION

⚠ If the *Pr. 2* setting is higher than the *Pr. 13 Starting frequency* value, note that the motor will run at the set frequency according to the acceleration time setting by merely switching the start signal on, without entry of the command frequency.

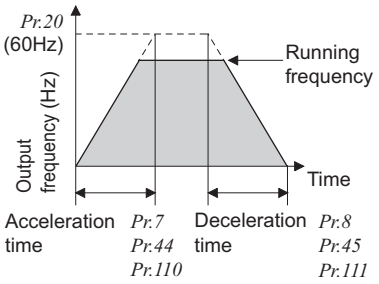
4.3.6 Change acceleration and deceleration time (Pr. 7, Pr. 8)

Set in *Pr. 7 Acceleration time* a larger value for a slower speed increase and a smaller value for a faster speed increase.
Set in *Pr. 8 Deceleration time* a larger value for a slower speed decrease and a smaller value for a faster speed decrease.

Parameter Number	Name	Initial Value		Setting Range	Description
7	**Acceleration time**	7.5K or lower	5s	0 to 3600/360s *	Set the motor acceleration time.
		11K or higher	15s		
8	**Deceleration time**	7.5K or lower	5s	0 to 3600/360s *	Set the motor deceleration time.
		11K or higher	15		

* Depends on the *Pr. 21 Acceleration/deceleration time increments* setting. The initial value for the setting range is "0 to 3600s" and setting increments is "0.1s".

Changing example — Change the *Pr. 7 Acceleration time* setting from "5s" to "10s".



Operation — **Display**

1. Screen at power-ON
   The monitor display appears.

2. Press (PU/EXT) to choose the PU operation mode.

(PU/EXT) ⇨ 

PU indicator is lit.

3. Press (MODE) to choose the parameter setting mode.

(MODE) ⇨ 

(The parameter number read previously appears.)

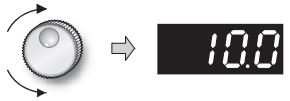
4. Turn dial until P. 7 (*Pr. 7*) appears.

5. Press (SET) to read the currently set value.
   "5.0"(initial value) appears.

(SET) ⇨ 

(The initial value differs according to the capacity.)

6. Turn dial to change it to the set value "10.0".



7. Press (SET) to set.

(SET) ⇨ 

Flicker ··· Parameter setting complete!!

· By turning dial, you can read another parameter.
· Press (SET) to show the setting again.
· Press (SET) twice to show the next parameter.

4.3.7 Selection of the start command and frequency command locations (Pr. 79)

Select the start command location and frequency command location.

<table>
<tr><th>Parameter Number</th><th>Name</th><th>Initial Value</th><th>Setting Range</th><th>Description</th><th>LED Indication
: Off
: On</th></tr>
<tr><td rowspan="8">79</td><td rowspan="8">Operation mode selection</td><td rowspan="8">0</td><td>0</td><td>Use External/PU switchover mode (press PU/EXT to switch between the PU and External operation mode. (Refer to page 83))
At power on, the inverter is in External operation mode.</td><td>PU operation mode
External operation mode
NET operation mode</td></tr>
<tr><td>1</td><td>Fixed to PU operation mode</td><td>PU operation mode</td></tr>
<tr><td>2</td><td>Fixed to External operation mode
Operation can be performed by switching between the external and NET operation mode.</td><td>External operation mode
NET operation mode</td></tr>
<tr><td>3</td><td>External/PU combined operation mode 1
Frequency command: PU (FR-DU07/FR-PU04/FR-PU07) setting or external signal input (multi-speed setting, across terminals 4-5 (valid when AU signal turns on)). *1
Start command: External signal input (terminal STF, STR)</td><td rowspan="2">External/PU combined operation mode</td></tr>
<tr><td>4</td><td>External/PU combined operation mode 2
Frequency command: External signal input (Terminal 2, 4, 1, JOG, multi-speed selection, etc.)
Start command: Input from the PU (FR-DU07/FR-PU04/FR-PU07) (FWD, REV)</td></tr>
<tr><td>6</td><td>Switchover mode
Switch among PU operation, external operation, and NET operation while keeping the same operating status.</td><td rowspan="2">PU operation mode
External operation mode
NET operation mode</td></tr>
<tr><td>7</td><td>External operation mode (PU operation interlock)
X12 signal ON *2
Operation mode can be switched to PU operation mode.
(output stop during external operation)
X12 signal OFF *2
Operation mode can not be switched to the PU operation mode.</td></tr>
</table>

*1 The priorities of the frequency commands when *Pr. 79* = "3" are "Multi-speed operation (RL/RM/RH/REX) > PID control (X14) > terminal 4 analog input (AU) > digital input from the operation panel".

*2 For the terminal used for the X12 signal (PU operation interlock signal) input, set "12" in *Pr. 178 to Pr. 189 (input terminal function selection)* to assign functions.

For *Pr. 178 to Pr. 189*, refer to *Chapter 4 of the Instruction Manual (Applied).*
When the X12 signal is not assigned, function of the MRS signal switches from MRS (output stop) to PU operation interlock signal.

4.3.8 Large starting torque and low speed torque are necessary (Advanced magnetic flux vector control, Real sensorless vector control) (Pr. 71, Pr. 80, Pr. 81, Pr. 800)

Magnetic flux Sensorless

Advanced magnetic flux vector control can be selected by setting the capacity, poles and type of the motor used in *Pr. 80* and *Pr. 81*. Real sensorless vector control can be selected for applications requiring high accuracy and fast response control. Perform offline auto tuning and online auto tuning when using Real sensorless vector control.

- What is Advanced magnetic flux vector control?
  The low speed torque can be improved by providing voltage compensation to flow a motor current which meets the load torque. Output frequency compensation (slip compensation) is made so that the motor actual speed approximates a speed command value. Effective when load fluctuates drastically, etc.
  Low-speed torque is improved as compared to V/F control. In addition, speed accuracy is improved when load is applied.
- What is Real sensorless vector control?
  This function enables vector control with a general-purpose motor without encoder. Low speed torque and speed accuracy are improved as compared to Advanced magnetic flux vector control. Always perform offline auto tuning and online auto tuning when using Real sensorless vector control.
  Real sensorless vector control is suitable for the following applications.
  · To minimize the speed fluctuation even at a severe load fluctuation
  · To generate low speed torque
  · To prevent machine from damage due to too large torque (torque limit)
  · To perform torque control

Parameter Number	Name	Initial Value	Setting Range	Description	
71	Applied motor	0	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54	By selecting a standard motor or constant-torque motor, thermal characteristic and motor constants of each motor are set.	
80	Motor capacity	9999	0.4 to 55kW	Set the applied motor capacity.	
			9999	V/F control	
81	Number of motor poles	9999	2, 4, 6, 8, 10	Set the number of motor poles.	
			12, 14, 16, 18, 20	X18 signal-ON:V/F control *	Set 10 + number of motor poles.
			9999	V/F control	
800	Control method selection	20	0 to 5	Vector control *(Refer to page 66)*	
			9	Vector control test operation	
			10	Speed control	Real sensorless vector control
			11	Torque control	
			12	MC signal-ON:torque MC signal-OFF:speed *	
			20	V/F control (Advanced magnetic flux vector control)	

* Use *Pr. 178 to Pr. 189* to assign the terminals used for the X18 and MC signal. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

POINT

If the following conditions are not satisfied, select V/F control since malfunction such as insufficient torque and uneven rotation may occur.

· The motor capacity should be equal to or one rank lower than the inverter capacity.
· Motor to be used is either Mitsubishi standard motor (SF-JR 3.7kW or higher), high efficiency motor (SF-HR 3.7kW or higher) or Mitsubishi constant-torque motor (SF-JRCA 4P, SF-HRCA 3.7kW or more). When using a motor other than the above (other manufacturer's motor), perform offline auto tuning without fail. (Advanced magnetic flux vector control)
  When performing Real sensorless vector control, offline auto tuning are necessary even when Mitsubishi motor is used.
· Single-motor operation (one motor run by one inverter) should be performed.
· The wiring length from inverter to motor should be within 30m. (Perform offline auto tuning in the state where actual wiring work is performed when the wiring length exceeds 30m.)

CAUTION

· Uneven rotation slightly increases as compared to the V/F control. (It is not suitable for machines such as grinding machine and wrapping machine which requires less uneven rotation at low speed.)
· Changing the terminal assignment using *Pr. 178 to Pr. 189 (input terminal function selection)* may affect the other functions. Please make setting after confirming the function of each terminal.
· When Advanced magnetic flux vector control is performed with a surge voltage suppression filter (FR-ASF-H) connected, output torque may decrease.
· Do not perform Real sensorless vector control with a surge voltage suppression filter (FR-ASF-H) connected.

<Selection method of Advanced magnetic flux vector control>

Perform secure wiring. *(Refer to page 12.)*

↓

Set the motor. *(Pr. 71) (Refer to page 63.)*

Motor		*Pr. 71* Setting *1	Remarks
Mitsubishi standard motor Mitsubishi high efficiency motor	SF-JR	0 (initial value)	
	SF-HR	40	
	Others	3	Offline auto tuning is necessary.*2
Mitsubishi constant-torque motor	SF-JRCA 4P	1	
	SF-HRCA	50	
	Others (SF-JRC, etc.)	13	Offline auto tuning is necessary. *2
Other manufacturer's standard motor	–	3	Offline auto tuning is necessary. *2
Other manufacturer's constant-torque motor	–	13	Offline auto tuning is necessary. *2

*1 For other settings of *Pr. 71* , refer to *Chapter 4 of the Instruction Manual (Applied).*

*2 Refer to *page 71* for offline auto tuning.

↓

Set the motor capacity and the number of motor poles according as required.
(Pr. 80, Pr. 81) (Refer to page 63.)

↓

Set the motor capacity (kW) in *Pr. 80 Motor capacity* and set the number of motor poles (number of poles) in *Pr. 81 Number of motor poles*. (V/F control is performed when the setting is "9999" (initial value).

Set the run command. *(Refer to page 83.)*

↓

Select the start command and speed command.
(1) Start command

1) Operation panel: Setting by pressing FWD / REV of the operation panel
2) External command: Setting by forward rotation or reverse rotation command (terminal STF or STR)

(2)Speed command

1) Operation panel: Setting by pressing of the operation panel
2) External analog command (terminal 2 or 4) :
Give a speed command using the analog signal input to terminal 2 (or terminal 4).
3) Multi-speed command:
The external signals (RH, RM, RL) may also be used to give speed command.

↓

Test run

As required

- Perform offline auto tuning. *(Pr.96) (refer to page 71).*
- Select online auto tuning. *(Pr.95) (refer to page 76).*

REMARKS

- When higher accuracy operation is necessary, set Real sensorless vector control after performing offline auto tuning and select Real sensorless vector control.
- Use *Pr. 89* to adjust the motor speed fluctuation at load fluctuation. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

<Selection method of Real sensorless vector control (speed control) >

Speed control is exercised to match the speed command and actual motor speed.

Perform secure wiring. *(Refer to page 12.)*

↓

Set the motor. *(Pr. 71)* *(Refer to page 64.)*

↓

Set "3" (standard motor) or "13" (constant-torque motor) in *Pr. 71 Applied motor*.

Set the motor capacity and the number of motor poles. *(Pr. 80, Pr. 81)* *(Refer to page 75.)*

↓

Set the motor capacity (kW) in *Pr. 80 Motor capacity* and set the number of motor poles (number of poles) in *Pr. 81 Number of motor poles*.
(V/F control is performed when the setting is "9999" (initial value).)

Select a control method. *(Refer to page 63)*

↓

Set "10" (speed control) or "12" (speed-torque switchover) in *Pr. 800* and make speed control valid.

Set the operation command. *(Refer to page 83)*

↓

Select the start command and speed command.

(1) Start command

1) Operation panel: Setting by pressing FWD / REV of the operation panel

2) External command: Setting by forward rotation and reverse rotation command (terminal STF or STR)

(2) Speed command

1) Operation panel: Setting by turning of the operation panel

2) External analog command (terminal 2 or 4) :
Give a speed command using the analog signal input to terminal 2 (or terminal 4).

3) Multi-speed command:
The external signals (RH, RM, RL) may also be used to give speed command.

Set the torque limit. *(Pr. 810)*
(Refer to Chapter 4 of the Instruction Manual (Applied).)

↓

Perform offline auto tuning. *(Pr. 96)* *(Refer to page 71.)*

↓

Test run

As required

- Easy gain tuning *(Refer to page 77)*
- Select online auto tuning. *(Pr. 95)* *(Refer to page 76)*
- Manual input speed control gain adjustment *(Refer to page 79)*

CAUTION

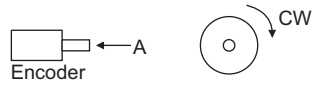
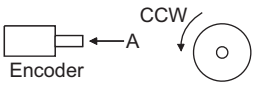
- Make sure to perform offline auto tuning before performing Real sensorless vector control.
- Speed command setting range is 0 to 120Hz for Real sensorless vector control.
- The carrier frequencies are selectable from among 2k, 6k, 10k, 14kHz for Real sensorless vector control.
- Torque control can not be performed in the low speed (approx. 10Hz or less) regeneration range and with light load at low speed (approx. 20% or less of rated torque at approx. 5Hz or less). Choose vector control.
- Performing pre-excitation (LX signal and X13 signal) under torque control may start the motor running at a low speed even when the start command (STF or STR) is not input. The motor may run also at a low speed when the speed limit value = 0 with a start command input. Perform pre-excitation after making sure that there will be no problem in safety if the motor runs.
- Do not switch between the STF (forward rotation command) and STR (reverse rotation command) during operation under torque control. Overcurrent trip (E.OC☐) or opposite rotation deceleration fault (E.11) occurs.
- When the inverter is likely to start during motor coasting under Real sensorless vector control, set to make frequency search of automatic restart after instantaneous power failure valid (*Pr. 57* ≠ "9999", *Pr. 162* = "10").
- Enough torque may not be generated in the ultra-low speed range less than approx. 2Hz when performing Real sensorless vector control.
  The guideline of speed control range is as shown below.

Driving:	1:200	(2, 4, 6 poles)	Can be used at 0.3Hz or more at rated 60Hz
	1:30	(8, 10 poles)	Can be used at 2Hz or more at rated 60Hz
Regeneration:	1:12	(2 to 10 poles)	Can be used at 5Hz or more at rated 60Hz

4.3.9 Higher accuracy operation using a motor with encoder (Vector control) (Pr.71, Pr.80, Pr.81, Pr.359, Pr.369, Pr.800) Vector

Full-scale vector control can be performed fitting the FR-A7AP/FR-A7AL (option) and using a motor with encoder. Fast response/high accuracy speed control (zero speed control, servo lock), torque control, and position control can be performed.

- What is vector control?
  Excellent control characteristics when compared to V/F control and other control techniques, achieving the control characteristics equal to those of DC machines.
  It is suitable for applications below.
  - · To minimize the speed fluctuation even at a severe load fluctuation
  - · To generate low speed torque
  - · To prevent machine from damage due to too large torque (torque limit)
  - · To perform torque control or position control
  - · Servo-lock torque control which generates a torque at zero speed (i.e. status of motor shaft = stopped)

Parameter Number	Name	Initial Value	Setting Range	Description
71	Applied motor	0	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54	By selecting a standard motor or constant-torque motor, thermal characteristic and motor constants of each motor are set.
80	Motor capacity	9999	0.4 to 55kW	Set the applied motor capacity.
			9999	V/F control
81	Number of motor poles	9999	2, 4, 6, 8, 10	Set the number of motor poles.
			12, 14, 16, 18, 20	X18 signal-ON:V/F control * / Set 10 + number of motor poles.
			9999	V/F control
359	Encoder rotation direction	1	0	 Clockwise direction as viewed from A is forward rotation
			1	 Counter clockwise direction as viewed from A is forward rotation
369	Number of encoder pulses	1024	0 to 4096	Set the number of pulses of the encoder. Set the number of pulses before multiplied by four.
800	Control method selection	20	0	Speed control / Vector control
			1	Torque control / Vector control
			2	MC signal-ON:torque MC signal-OFF:speed * / Vector control
			3	Position control / Vector control
			4	MC signal-ON:position MC signal-OFF:speed * / Vector control
			5	MC signal-ON:torque MC signal-OFF:position * / Vector control
			9	Vector control test operation *(Refer to Chapter 4 of the Instruction Manual (Applied).)*
			10 to 12	Real sensorless vector control *(Refer to page 64)*
			20	V/F control (Advanced magnetic flux vector control)

* Use *Pr. 178 to Pr. 189* to assign the terminals used for the X18 and MC signal. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

POINT

If the conditions below are not satisfied, malfunction such as insufficient torque and uneven rotation may occur.

- The motor capacity should be equal to or one rank lower than the inverter capacity.
- Motor to be used is any of Mitsubishi standard motor with encoder (SF-JR 3.7kW or higher), high efficiency motor with encoder (SF-HR 3.7kW or higher) or Mitsubishi constant torque motor with encoder (SF-JRCA 4P, SF-HRCA 3.7kW or higher) or vector control dedicated motor (SF-V5RU (1500r/min series)). When using a motor other than the above (other manufacturer's motor), perform offline auto tuning without fail.
- Single-motor operation (one motor run by one inverter) should be performed.
- Wiring length from inverter to motor should be within 30m. (Perform offline auto tuning in the state where wiring work is performed when the wiring length exceeds 30m.)

CAUTION

- Changing the terminal assignment using *Pr. 178 to Pr. 189 (input terminal function selection)* may affect the other functions. Make setting after confirming the function of each terminal.
- Do not perform vector control with a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) connected.

<Selection method of speed control>

Speed control is exercised to match the speed command and actual motor speed.

Perform secure wiring. *(Refer to page 31.)*

↓ Mount the FR-A7AP/FR-A7AL (option).

Set the motor and encoder. *(Pr. 71, Pr. 359, Pr. 369)*

↓ Set *Pr. 71 Applied motor*, *Pr. 359 Encoder rotation direction* and *Pr. 369 Number of encoder pulses* according to the motor and encoder used. *(Refer to page 33.)*

Set the motor capacity and the number of motor poles
(Pr. 80, Pr. 81) (Refer to page 66.)

↓ Set the motor capacity (kW) in *Pr. 80 Motor capacity* and set the number of motor poles (number of poles) in *Pr. 81 Number of motor poles*. (V/F control is performed when the setting is "9999" (initial value).)

Select a control method. *(Refer to page 66.)*

↓ Make speed control valid by selecting "0" (speed control), "2" (speed-torque switchover), or "4" (speed-position switchover) for *Pr. 800*.

Set the run command. *(Refer to page 85.)*

↓ Select the start command and speed command.

(1) Start command

1)Operation panel: Setting by pressing FWD/REV of the operation panel

2)External command: Setting by forward rotation or reverse rotation command (terminal STF or STR)

(2)Speed command

1)Operation panel: Setting by pressing of the operation panel

2)External analog command (terminal 2 or 4) :
Give a speed command using the analog signal input to terminal 2 (or terminal 4).

3)Multi-speed command:
The external signals (RH, RM, RL) may also be used to give speed command.

Set the torque limit. *(Pr. 810)*
(Refer to Chapter 4 of the Instruction Manual (Applied).)

↓

Test run

As required

- Perform offline auto tuning. *(Pr. 96) (refer to page 71)*.
- Select online auto tuning. *(Pr. 95) (refer to page 76)*.
- Easy gain tuning *(refer to page 77)*
- Manual input speed control gain adjustment *(refer to page 79)*

CAUTION

- Speed command setting range is 0 to 120Hz for vector control.
- The carrier frequencies are selectable among 2k, 6k, 10k, and 14kHz for vector control.

<Selection method of torque control>

- Torque control is exercised to develop torque as set in the torque command.
- The motor speed becomes constant when the motor output torque and load torque are balanced. For torque control, therefore, the speed is determined by the load.
- For torque control, the motor gains speed as the motor output torque becomes greater than the motor load. To prevent overspeed, set the speed limit value so that the motor speed does not increase too high. (Speed control is exercised during speed limit and torque control is disabled.)
- When speed limit is not set, the speed limit value setting is regarded as 0Hz to disable torque control.

Perform secure wiring. *(Refer to page 31.)*

↓ Mount the FR-A7AP/FR-A7AL (option).

Set the motor and encoder. *(Pr. 71, Pr. 359, Pr. 369)*

↓ Set *Pr. 71 Applied motor*, *Pr. 359 Encoder rotation direction* and *Pr. 369 Number of encoder pulses* according to the motor and encoder used. *(Refer to page 33.)*

Set the motor capacity and the number of motor poles. *(Pr. 80, Pr. 81)*
(Refer to page 66.)

↓ Set the motor capacity (kW) in *Pr. 80 Motor capacity* and set the number of motor poles in *Pr. 81 Number of motor poles*. (V/F control is performed when the setting is "9999" (initial value).)

Select a control method. *(Refer to page 66.)*

↓ Set either "1" (torque control), "2" (speed-torque switchover) or "5" (position-torque switchover) in *Pr. 800* and make torque control valid.

Set the torque command. *(Pr. 804)*
(Refer to Chapter 4 of the Instruction Manual (Applied).)

↓

Set the speed limit. *(Pr. 807)*
(Refer to Chapter 4 of the Instruction Manual (Applied).)

↓

Test run

As required

- Perform offline auto tuning. *(Pr. 96) (refer to page 71).*
- Select online auto tuning. *(Pr. 95) (refer to page 76).*
- Manual input torque control gain adjustment *(refer to Chapter 4 of the Instruction Manual (Applied))*

CAUTION

- The carrier frequencies are selectable among 2k, 6k, 10k, and 14kHz for vector control.

<Selection method of position control>

- In the position control, the speed command is calculated so that the difference between command pulse (or parameter setting) and the number of feedback pulses from the encoder is zero to run the motor.
- This inverter can perform simple position feed by contact input, position control by inverter simple pulse input, and position control by FR-A7AL pulse train input.

Perform secure wiring. *(Refer to page 32.)*

↓ Mount the FR-A7AP/FR-A7AL (option).

Set the motor and encoder. *(Pr. 71, Pr. 359, Pr. 369)*

↓ Set *Pr. 71 Applied motor*, *Pr. 359 Encoder rotation direction* and *Pr. 369 Number of encoder pulses* according to the motor and encoder used. *(Refer to page 33.)*

Set the motor capacity and the number of motor poles. *(Pr. 80, Pr. 81) (Refer to page 66.)*

↓ Set the motor capacity (kW) in *Pr. 80 Motor capacity* and set the number of motor poles (number of poles) in *Pr. 81 Number of motor poles*. (V/F control is performed when the setting is "9999" (initial value).)

Select a control method. *(Refer to page 66.)*

↓ Make speed control valid by selecting "3" (position control) "4" (speed-position switchover) or "5" (position-torque switchover) for *Pr. 800*.

Selection of position command source. *(Pr. 419)*

↓ Position command by contact input
Set "0" (initial value) in *Pr. 419*.

Setting of parameter for position feed *(Pr. 465 to Pr. 494)*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

↓ Position command by inverter pulse train input
Set "2" in *Pr. 419*.

Selection of command pulse form. *(Pr. 428)* *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

↓ Position command from the positioning module of the programmable controller system (through FR-A7AL)
Set *Pr. 419* = "1"

Refer to the Instruction Manual of FR-A7AL.

Test run

As required

- Set the electronic gear. *(refer to Chapter 4 of the Instruction Manual (Applied))*
- Setting of positioning adjustment parameter *(refer to Chapter 4 of the Instruction Manual (Applied))*
- Gain adjustment of position control *(refer to Chapter 4 of the Instruction Manual (Applied))*

CAUTION

- The carrier frequencies are selectable among 2k, 6k, 10k, and 14kHz for vector control.

4.3.10 Exhibiting the best performance of the motor performance (offline auto tuning) (Pr. 71, Pr. 83, Pr. 84, Pr. 96) Magnetic flux Sensorless Vector

The motor performance can be maximized with offline auto tuning.

- What is offline auto tuning?
  When performing Advanced magnetic flux vector control, Real sensorless vector control or vector control, the motor can be run with the optimum operating characteristics by automatically measuring the motor constants (offline auto tuning) even when each motor constants differs, other manufacturer's motor is used, or the wiring length is long. (30m or longer as reference)

Parameter Number	Name	Initial Value	Setting Range	Description
71	**Applied motor**	0	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54	By selecting a standard motor or constant-torque motor, thermal characteristic and motor constants of each motor are set.
83	**Rated motor voltage**	200/400V *	0 to 1000V	Set the rated motor voltage(V). * The initial value differs according to the voltage level. (200V/400V)
84	**Rated motor frequency**	60Hz	10 to 120Hz	Set the rated motor frequency (Hz).
96	**Auto tuning setting/ status**	0	0	Offline auto tuning is not performed
			1	Offline auto tuning is performed without motor running
			101	Offline auto tuning is performed with motor running

POINT

- This function is valid only when a value other than "9999" is set in *Pr. 80* and *Pr. 81* and Advanced magnetic flux vector control, Real sensorless vector control or vector control is selected.
- You can copy the offline auto tuning data (motor constants) to another inverter with the PU (FR-DU07/FR-PU07).
- Even when motors (other manufacturer's motor, SF-JRC, etc.) other than Mitsubishi standard motor (SF-JR 3.7kW or higher), high efficiency motor (SF-HR 3.7kW or higher), Mitsubishi constant-torque motor (SF-JRCA 4P, SF-HRCA 3.7kW or higher) and vector control dedicated motor (SF-V5RU (1500r/min series)) are used or the wiring length is long (30m or longer as reference), using the offline auto tuning function runs the motor with the optimum operating characteristics.
- Tuning is enabled even when a load is connected to the motor. (As the load is lighter, tuning accuracy is higher. Tuning accuracy does not change even if the inertia is large.)
- For the offline auto tuning, you can select either the motor non-rotation mode (*Pr. 96* = "1") or rotation mode (*Pr. 96* = "101").
- The rotation mode has higher tuning accuracy than the non-rotation mode.
- Reading/writing/copy of motor constants tuned by offline auto tuning are enabled.
- The offline auto tuning status can be monitored with the PU (FR-DU07/FR-PU07/FR-PU04).
- Do not use an inverter with a surge voltage suppression filter (FR-ASF-H) connected between the inverter and motor.

(1) Before performing offline auto tuning

Check the following before performing offline auto tuning.

- Make sure Advanced magnetic flux vector control *(Pr. 80, Pr. 81)*, Real sensorless vector control or vector control *(Pr. 800)* is selected. *(Refer to page 63)*
- A motor should be connected. Note that the motor should be at a stop at a tuning start.
- The motor capacity should be equal to or one rank lower than the inverter capacity.
- Motors such as high-slip motor, high-speed motor and special motor cannot be tuned. (The maximum frequency is 120Hz.)
- Even if tuning is performed without motor running (*Pr. 96 Auto tuning setting/status* = "1"), the motor may run slightly. Therefore, fix the motor securely with a mechanical brake, or before tuning, make sure that there will be no problem in safety if the motor runs. (Caution is required especially in vertical lift applications). Note that if the motor runs slightly, tuning performance is unaffected.
- Note the following when selecting offline auto tuning performed with motor running (*Pr. 96 Auto tuning setting/status* = "101").
  Torque is not enough during tuning.
  The motor may be run at nearly its rated speed.
  The mechanical brake is open.
  No external force is applied to rotate the motor.
- Offline auto tuning will not be performed properly if it is performed with a surge voltage suppression filter (FR-ASF-H) connected between the inverter and motor. Remove it before starting tuning.
- When exercising vector control, use the encoder that is coupled directly to the motor shaft without looseness.
  Speed ratio should be 1:1.

(2) Setting

1) Select the Advanced magnetic flux vector control, Real sensorless vector control or vector control.
2) Set "1" or "101" in *Pr. 96 Auto tuning setting/status* .
   · When the setting is "1" . . . . . Tuning is performed without motor running.
   It takes approximately 25 to 120s * until tuning is completed.
   (Excitation noise is produced during tuning.)
   *Tuning time differs according to the inverter capacity and motor type.
   · When the setting is "101" . . . . . Tuning is performed with motor running.
   It takes approximately 40s until tuning is completed.
   The motor runs at nearly its rated frequency.
3) Set the rated motor current (initial value is rated inverter current) in *Pr. 9 Electronic thermal O/L relay*.
4) Set the rated voltage of motor (initial value is 200V/400V) in *Pr. 83 Rated motor voltage* and rated frequency of motor (initial value is 60Hz) in *Pr. 84 Rated motor frequency* .
   (For a Japanese standard motor, etc. which has both 50Hz and 60Hz rated values, set 200V/60Hz or 400V/60Hz).)
   For vector control dedicated motor SF-V5RU1 / V5RU3 / V5RU4, set as the following table.

	***Pr. 83* Setting**	***Pr. 84* Setting**
SF-V5RU1-30kW or less	160V	33.33Hz
SF-V5RU1-37kW	170V	
SF-V5RU3-22kW or less	160V	
SF-V5RU3-30kW	170V	
SF-V5RU4-3.7kW, 7.5kW	150V	16.67Hz
SF-V5RU4-other than the above	160V	

REMARKS

· When using the vector control dedicated motor SF-V5RU (1500r/min series) or SF-THY, setting 33 and 34 in *Pr. 71* selects internal constants appropriate for dedicated motors. Therefore, *Pr. 83* and *Pr. 84* settings are unnecessary.
· Perform auto tuning for SF-V5RU (except for 1500 r/min series) with setting 13 or 14 in *Pr. 71* (For perform auto tuning, set *Pr. 83* and *Pr. 84*)
· When *Pr. 11 DC injection brake operation time* = "0" or *Pr.12 DC injection brake operation voltage* = "0," offline auto tuning is performed at the initial setting of *Pr. 11* or *Pr. 12*.
· When the positioning control is selected (*Pr. 800* = "3" or "5" (when MC signal is OFF)), offline auto tuning is not performed.

5) Set *Pr. 71 Applied motor* according to the motor used.

Motor		***Pr. 71* Setting** *
Mitsubishi standard motor Mitsubishi high efficiency motor	SF-JR	3
	SF-HR	43
	Others	3
Mitsubishi constant-torque motor	SF-JRCA 4P	13
	SF-HRCA	53
	Others (SF-JRC, etc.)	13
Vector control dedicated motor	SF-V5RU (1500r/min series) SF-THY	33
	SF-V5RU (except for 1500r/min series)	13
Other manufacturer's standard motor	–	3
Other manufacturer's constant-torque motor	–	13

* For other settings of *Pr. 71*, refer to *Chapter 4 of* 📖 *the Instruction Manual (Applied)*.

(3) Execution of tuning

CAUTION

· Before performing tuning, check the monitor display of the operation panel (FR-DU07) or parameter unit (FR-PU04/FR-PU07) if the inverter is in the state ready for tuning. (Refer to 2) below) When the start command is turned ON under V/F control, the motor starts.

1)When performing PU operation, press (FWD)/(REV) of the operation panel.

For external operation, turn ON the start command (STF signal or STR signal). Tuning starts.

REMARKS

· The offline auto tuning starts when the inverter start conditions, including the ON status of the MRS signal, are met.

· To force tuning to end, use the MRS or RES signal or press (STOP/RESET) of the operation panel.
(Turning the start signal (STF signal or STR signal) off also ends tuning.)

· During offline auto tuning, only the following I/O signals are valid: (initial value)
· Input signals <valid signal> STOP, OH, MRS, RT, CS, RES, STF, STR
· Output terminal RUN, OL, IPF, FM, AM, A1B1C1
Note that the progress status of offline auto tuning is output in fifteen steps from AM and FM when speed and output frequency are selected.

· Do not perform ON/OFF switching of the second function selection signal (RT) during execution of offline auto tuning. Auto tuning is not executed properly.

· Setting offline auto tuning (*Pr. 96 Auto tuning setting/status* = "1 or 101") will make pre-excitation invalid.

CAUTION

· When selecting offline auto tuning performed with motor running (*Pr. 96 Auto tuning setting/status* = "101"), caution must be taken since the motor runs.

· Since the RUN signal turns on when tuning is started, caution is required especially when a sequence which releases a mechanical brake by the RUN signal has been designed.

· When executing offline auto tuning, input the run command after switching on the main circuit power (R/L1, S/L2, T/L3) of the inverter.

· When *Pr.79* = "7," turn ON the X12 signal and select the PU operation mode to perform tuning.

2)Monitor is displayed on the operation panel (FR-DU07) and parameter unit (FR-PU07/FR-PU04) during tuning as below.

	Parameter Unit (FR-PU07/FR-PU04) Display		Operation Panel (FR-DU07) Display	
Pr. 96 setting	1	101	1	101
(1) Setting	1 --- STOP PU	101 --- STOP PU		
(2) Tuning in progress	TUNE 2 STF FWD PU	TUNE 102 STF FWD PU		
(3) Normal end	TUNE 3 COMPLETION STF STOP PU	TUNE 103 COMPLETION STF STOP PU	 Flickering	 Flickering
(4) Error end (when the inverter protective function is activated)	TUNE 9 ERROR STF STOP PU			

· Reference: Offline auto tuning time (when the initial value is set)

Offline Auto Tuning Setting	Time
Non-rotation mode (*Pr. 96* = "1")	Approximately 25 to 120s (Tuning time differs according to the inverter capacity and motor type.)
Rotation mode (*Pr. 96* = "101")	Approximately 40s (Offline auto tuning time varies with the acceleration and deceleration time settings as indicated below. Offline auto tuning time = acceleration time + deceleration time + approx. 30s)

3)When offline auto tuning ends, press STOP RESET of the operation panel during PU operation. For external operation, turn OFF the start signal (STF signal or STR signal).
This operation resets the offline auto tuning and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)

REMARKS

- Do not change the *Pr. 96* setting after completion of tuning (3 or 103).
  If the *Pr. 96* setting is changed, tuning data is invalid.
  If the *Pr. 96* setting is changed, tuning must be performed again.

4)If offline auto tuning ended in error (see the table below), motor constants are not set.
Perform an inverter reset and restart tuning.

Error Display	Error Cause	Remedy
8	Forced end	Set "1" or "101" in *Pr. 96* and perform tuning again.
9	Inverter protective function operation	Make setting again.
91	Current limit (stall prevention) function was activated.	Increase acceleration/deceleration time. Set "1" in *Pr. 156* .
92	Converter output voltage reached 75% of rated value.	Check for fluctuation of power supply voltage.
93	Calculation error A motor is not connected.	Check the motor wiring and make setting again. Set the rated current of the motor in *Pr.9*.

5)When tuning is ended forcibly by pressing STOP RESET or turning off the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)
Perform an inverter reset and restart tuning.

6)When using the motor corresponding to the following specifications and conditions, reset *Pr.9 Electronic thermal O/L relay* as below after tuning is completed.

a) When the rated power specifications of the motor is 200/220V (400/440V) 60Hz, set 1.1 times rated motor current value in *Pr.9*.

b) When performing motor protection from overheat using a PTC thermistor or motor with temperature detector such as Klixon, set "0" (motor overheat protection by the inverter is invalid) in *Pr.9*.

CAUTION

- The motor constants measured once in the offline auto tuning are stored as parameters and their data are held until the offline auto tuning is performed again.
- An instantaneous power failure occurring during tuning will result in a tuning error.
  After power is restored, the inverter goes into the normal operation mode. Therefore, when STF (STR) signal is on, the motor runs in the forward (reverse) rotation.
- Any alarm occurs during tuning is handled as in the ordinary mode. Note that if a fault retry has been set, retry is ignored.
- The set frequency monitor displayed during the offline auto tuning is 0Hz.

⚠ CAUTION

⚠ Note that the motor may start running suddenly.

⚠ When the offline auto tuning is used in vertical lift application, e.g. a lifter, it may drop due to insufficient torque.

4.3.11 High accuracy operation unaffected by the motor temperature (online auto tuning) (Pr. 95) Magnetic flux Sensorless Vector

When online auto tuning is selected under Advanced magnetic flux vector control, Real sensorless vector control or vector control, excellent torque accuracy is provided by temperature compensation even if the secondary resistance value of the motor varies with the rise of the motor temperature.

Parameter Number	Name	Initial Value	Setting Range	Description
95	Online auto tuning selection	0	0	Online auto tuning is not performed
			1	Start-time online auto tuning
			2	Magnetic flux observer (normal tuning)

(1) Start-time online auto tuning (setting is "1")

- By quickly tuning the motor constants at a start, high accuracy operation unaffected by the motor temperature and stable operation with high torque down to ultra low speed can be performed.
- Make sure Advanced magnetic flux vector control (*Pr. 80, Pr. 81*), Real sensorless vector control or vector control (*Pr. 800*) is selected. (*Refer to page 63*.)
- Before performing online auto tuning, perform offline auto tuning without fail.

<Operation method>

1) Check that "3" or "103" (offline auto tuning completion) is set in *Pr. 96 Auto tuning setting/status*.
2) Set "1" (start-time online auto tuning) in *Pr. 95 Online auto tuning selection*.
   Online auto tuning is performed from the next starting.
3) When performing PU operation, press FWD/REV of the operation panel.
   For external operation, turn ON the run command (STF signal or STR signal).

CAUTION

- For using start-time online auto tuning in elevator, examine the utilization of a brake sequence for the brake opening timing at a start. Though the tuning ends in about a maximum of 500ms after a start, torque is not provided fully during that period. Therefore, note that there may be a possibility of drop due to gravity.
  It is recommended to perform tuning using a start time tuning signal (X28). *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

(2) Magnetic flux observer (normal tuning) (setting value is "2")

- When exercising vector control using a motor with encoder, it is effective for torque accuracy improvement.
  The current flowing in the motor and the inverter output voltage are used to estimate/observe the magnetic flux in the motor.
  The magnetic flux of the motor is always (including during operation) detected with high accuracy so that an excellent characteristic is provided regardless of the change in the temperature of the secondary resistance.
- Vector control *(Pr. 80, Pr. 81, Pr. 800)* should be selected. *(Refer to page 75.)*

CAUTION

- For the SF-V5RU, SF-JR (with encoder), SF-HR (with encoder), SF-JRCA (with encoder) or SF-HRCA (with encoder), it is not necessary to perform offline auto tuning to select adaptive magnetic flux observer. (Note that it is necessary to perform offline auto tuning for the wiring length resistance to be reflected on the control when the wiring length is long (30m or longer as reference).

REMARKS

- Online auto tuning does not operate if the MRS signal is input, if the preset speed is less than the *Pr. 13 Starting frequency* (V/F control or Advanced magnetic flux vector control), or if the starting conditions of the inverter are not satisfied, e.g. inverter error.
- Online auto tuning does not operate during deceleration or at a restart during DC brake operation.
- Invalid for jog operation.
- Automatic restart after instantaneous power failure overrides when automatic restart after instantaneous power failure is selected. (Start-time online auto tuning is not performed at frequency search.)
  Perform online auto tuning at a stop with the X28 signal when using automatic restart after instantaneous power failure together. (Refer to *Chapter 4 of the Instruction Manual (Applied)* for details.)
- Zero current detection and output current detection are valid during online auto tuning.
- The RUN signal is not output during online auto tuning. The RUN signal turns on at a start.
- If the period from an inverter stop to a restart is within 4s, start-time tuning is performed but the tuning results are not reflected.

4.3.12 To perform high accuracy/fast response operation (gain adjustment of Real sensorless vector control and vector control) (Pr. 818 to Pr. 821, Pr. 880)

Sensorless Vector

The ratio of the load inertia to the motor inertia (load moment of inertia) is estimated in real time from the torque command and speed during motor operation by vector control. As optimum gain of speed control and position control are automatically set from the load inertia ratio and response level, time and effort of making gain adjustment are reduced. (Easy gain tuning)
When the load inertia ratio cannot be estimated due to load fluctuation or Real sensorless vector control is exercised, control gain is automatically set by manually inputting the load inertia ratio.
Make a manual input adjustment when vibration, noise or any other unfavorable phenomenon occurs due to large load inertia or gear backlash, for example, or when you want to exhibit the best performance that matches the machine.

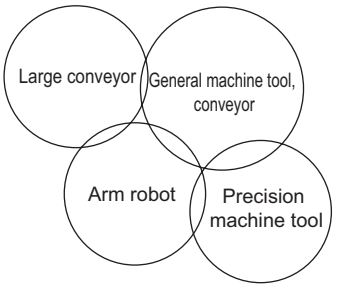
Parameter Number	Name	Initial Value	Setting Range	Description
818	Easy gain tuning response level setting	2	1 to 15	Set the response level. 1: Slow response to 15: Fast response
819	Easy gain tuning selection	0	0	Without easy gain tuning
			1	With load estimation, with gain calculation (valid only during vector control)
			2	With load *(Pr. 880)* manual input, gain calculation
820	Speed control P gain 1	60%	0 to 1000%	Set the proportional gain for speed control. (Increasing the value improves trackability in response to a speed command change and reduces speed variation with disturbance.)
821	Speed control integral time 1	0.333s	0 to 20s	Set the integral time during speed control. (Decrease the value to shorten the time taken for returning to the original speed if speed variation with disturbance occurs.)
880	Load inertia ratio	7 times	0 to 200 times	Set the load inertia ratio to the motor.

(1) Easy gain tuning execution procedure (*Pr. 819* = "1" load inertia ratio automatic estimation)

Easy gain tuning (load inertia ratio automatic estimation) is valid only in the speed control or position control mode under vector control.
It is invalid under torque control, V/F control, Advanced magnetic flux vector control and Real sensorless vector control.

1) Set the response level using *Pr. 818 Easy gain tuning response level setting*.
Refer to the diagram on the right and set the response level.
Increasing the value will improve trackability to the command, but too high value will generate vibration. The relationship between the setting and response level are shown on the right.

Pr. 818 setting	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Response level	Slow response ⟷							Middle response			⟷				Fast response
Guideline of mechanical resonance frequency (Hz)	8	10	12	15	18	22	28	34	42	52	64	79	98	122	150



2) Each control gain is automatically set from the load inertia ratio estimated during acceleration/deceleration operation and the *Pr. 818 Easy gain tuning response level setting* value.
Pr. 880 Load inertia ratio is used as the initial value of the load inertia ratio for tuning. Estimated value is set in *Pr. 880* during tuning.
The load inertia ratio may not be estimated well, e.g. it takes a long time for estimation, if the following conditions are not satisfied.
- Time taken for acceleration/deceleration to reach 1500r/min is 5s or less.
- Speed is 150r/min or more.
- Acceleration/deceleration torque is 10% or more of the rated torque.
- Abrupt disturbance is not applied during acceleration/deceleration.
- Load inertia ratio is approx. 30 times or less.
- No gear backlash nor belt looseness is found.

3) Press (FWD) or (REV) to estimate the load inertia ratio or calculate gain any time. (The operation command for external operation is the STF or STR signal.)

(2) Easy gain tuning execution procedure (*Pr. 819* = "2" load inertia manual input)

Easy gain tuning (load inertia ratio manual input) is valid only in the speed control mode under Real sensorless vector control or in the speed control or position control mode under vector control.

1) Set the load inertia ratio to the motor in *Pr. 880 Load inertia ratio*.
2) Set "2" (with easy gain tuning) in *Pr. 819 Easy gain tuning selection*. Then, *Pr. 820 Speed control P gain 1* and *Pr. 821 Speed control integral time 1* are automatically set by gain calculation.
Operation is performed in a gain adjusted status from the next operation.
3) Perform a test run and set the response level in *Pr. 818 Easy gain tuning response level setting*. Increasing the value will improve trackability to the command, but too high value will generate vibration. (When "2" (parameter write enabled during operation) is set in *Pr. 77 Parameter write selection* , response level adjustment can be made during operation.)

REMARKS

- When "1 or 2" is set in *Pr. 819* and then returned the *Pr. 819* setting to "0" after tuning is executed, tuning results which are set in each parameter remain unchanged.
- When good tuning accuracy is not obtained after executing easy gain tuning due to disturbance and such, perform fine adjustment by manual input. Set "0" (without easy gain tuning) in *Pr. 819*.

(3) Parameters automatically set by easy gain tuning

The following table indicates the relationship between easy gain tuning function and gain adjustment parameter.

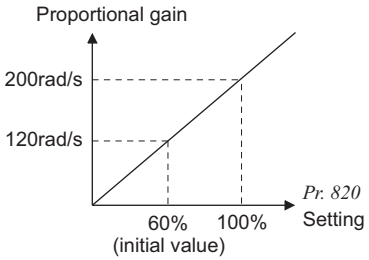
	Easy Gain Tuning Selection *(Pr. 819)* Setting		
	0	**1**	**2**
Load inertia ratio *(Pr. 880)*	Manual input	a) Inertia estimation result (RAM) by easy gain tuning is displayed. b) Set the value in the following cases: • Every hour after power-ON • When a value other than "1" is set in *Pr. 819* • When vector control is changed to other control (V/F control etc.) using *Pr. 800* c) Write is enabled only during a stop (manual input)	Manual input
Speed control P gain 1 *(Pr. 820)* Speed control integral time 1 *(Pr. 821)* Model speed control gain *(Pr. 828)* Position loop gain *(Pr. 422)*	Manual input	a) Tuning result (RAM) is displayed. b) Set the value in the following cases: • Every hour after power-on • When a value other than "1" is set in *Pr. 819* • When vector control is changed to other control (V/F control etc.) using *Pr. 800* c) Write (manual input) disabled	a) Gain is calculated when "2" is set in *Pr. 819* and the result is set in the parameter. b) When the value is read, the tuning result (parameter setting value) is displayed. c) Write (manual input) disabled

CAUTION

- Performing easy gain tuning with larger inertia than the specified value during vector control may cause malfunction such as hunting. In addition, when the motor shaft is fixed with servo lock or position control, bearing may be damaged. To prevent these, make gain adjustment by manual input without performing easy gain tuning.

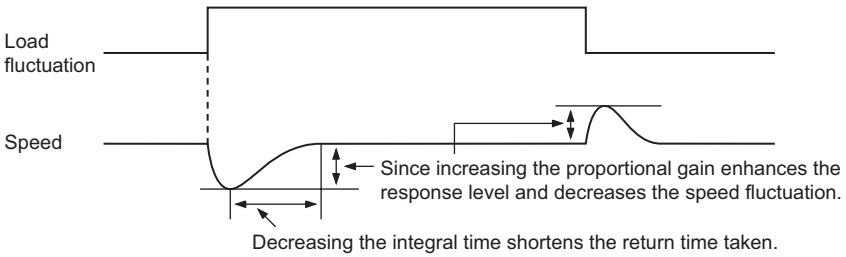
(4) Manual input speed control gain adjustment

· Make adjustment when any of such phenomena as unusual machine vibration/noise, low response level and overshoot has occurred.



· The response speed of a motor is equivalent to 120rad/s when *Pr.820 Speed control P gain 1* = "60% (initial setting)." Increasing the setting value improves the response level, but setting too large of a gain will produce vibration and/or unusual noise.
· Decreasing the *Pr. 821 Speed control integral time 1* shortens the return time taken at a speed change. However, a too short time will generate an overshoot.

· When there is load inertia, the actual speed gain is as given below.



$$\text{Actual speed gain} = \text{speed gain of motor without load} \times \frac{JM}{JM+JL}$$

JM: Inertia of the motor
JL: Motor shaft-equivalent load inertia

· Adjustment procedures are as below:
1)Check the conditions and simultaneously change the *Pr. 820* value.
2)If you cannot make proper adjustment, change the *Pr. 821* value and repeat step 1).

No.	Phenomenon/ Condition	Adjustment Method	
1	Load inertia is large	Set the *Pr. 820* and *Pr. 821* values a little higher.	
		Pr. 820	When a speed rise is slow, increase the value 10% by 10% until just before vibration/noise is produced, and set about 0.8 to 0.9 of that value.
		Pr. 821	If an overshoot occurs, double the value until an overshoot does not occur, and set about 0.8 to 0.9 of that value.
2	Vibration/noise generated from mechanical system	Set the *Pr. 820* value a little lower and the *Pr. 821* value a little higher.	
		Pr. 820	Decrease the value 10% by 10% until just before vibration/noise is not produced, and set about 0.8 to 0.9 of that value.
		Pr. 821	If an overshoot occurs, double the value until an overshoot does not occur, and set about 0.8 to 0.9 of that value.
3	Slow response	Set the *Pr. 820* value a little higher.	
		Pr. 820	When a speed rise is slow, increase the value 5% by 5% until just before vibration/noise is produced, and set about 0.8 to 0.9 of that value.
4	Long return time (response time)	Set the *Pr. 821* value a little lower.	
		Decrease the *Pr. 821* value by half until just before an overshoot or the unstable phenomenon does not occur, and set about 0.8 to 0.9 of that value.	
5	Overshoot or unstable phenomenon occurs.	Set the *Pr. 821* value a little higher.	
		Increase the *Pr. 821* value double by double until just before an overshoot or the unstable phenomenon does not occur, and set about 0.8 to 0.9 of that value.	

REMARKS

· When making manual input gain adjustment, set "0" (without easy gain tuning) (initial value) in *Pr. 819 Easy gain tuning selection*.

(5) When using a multi-pole motor (8 poles or more)

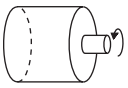
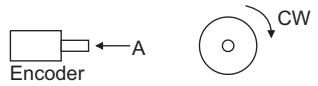
Specially when using a multi-pole motor with more than 8 poles under Real sensorless vector control or vector control, adjust *Pr. 820 Speed control P gain 1* and *Pr. 824 Torque control P gain 1* according to the motor referring to the following methods.

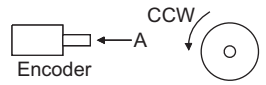
- For *Pr. 820 Speed control P gain 1*, increasing the setting value improves the response level, but a too large gain will produce vibration and/or unusual noise.
- For *Pr. 824 Torque control P gain 1*, note that a too low value will produce current ripples, causing the motor to generate sound synchronizing the cycle of current ripples.

Adjustment method

No.	Phenomenon/Condition	Adjustment Method
1	The motor rotation is unstable in the low speed range.	Set a higher value in *Pr. 820 Speed control P gain 1* according to the motor inertia. Since the self inertia of a multi-pole motor tends to become large, make adjustment to improve the unstable phenomenon, then make fine adjustment in consideration of the response level using that setting as reference. In addition, when performing vector control with encoder, gain adjustment according to the inertia can be easily done using easy gain tuning (*Pr. 819* = 1).
2	Speed trackability is poor.	Set a higher value in *Pr. 820 Speed control P gain 1*. Increase the value 10% by 10% until just before vibration or unusual noise is produced, and set about 0.8 to 0.9 of that value. If you cannot make proper adjustment, increase the value of *Pr. 821 Speed control integral time 1* double by double and make adjustment of *Pr. 820* again.
3	Speed variation at the load fluctuation is large.	
4	Torque becomes insufficient or torque ripple occurs at starting or in the low speed range under Real sensorless vector control.	Set the speed control gain a little higher. (same as No. 1) If the problem still persists after gain adjustment, increase *Pr. 13 Starting frequency* or set the acceleration time shorter if the inverter is starting to avoid continuous operation in the ultra low speed range.
5	Unusual motor and machine vibration, noise or overcurrent occurs.	Set a lower value in *Pr. 824 Torque control P gain 1*. Decrease the value 10% by 10% until just before the phenomenon is improved, and set about 0.8 to 0.9 of that value.
6	Overcurrent or overspeed (E.OS) occurs at a start under Real sensorless vector control.	

(6) Troubleshooting (speed)

<table>
<tr><th></th><th>Phenomenon</th><th>Cause</th><th>Countermeasures</th></tr>
<tr><td rowspan="5">1</td><td rowspan="5">Motor does not rotate.
(Vector control)</td><td>(1) The motor wiring is wrong</td><td>(1) Wiring check
Select V/F control (set "9999" in Pr. 80 or Pr. 81) and check the rotation direction of the motor.
For the SF-V5RU (1500r/min series), set "160V (320V)" in Pr. 19 Base frequency voltage, and set "50Hz" in Pr. 3 Base frequency.
 
When the forward rotation signal is input, the motor running in the counterclockwise direction as viewed from the motor shaft is normal. (If it runs in the clockwise direction, the phase sequence of the inverter output side wiring is incorrect.)</td></tr>
<tr><td>(2) Encoder specifications (encoder specification selection switch FR-A7AP/FR-A7AL (option)) are wrong</td><td>(2) Check the encoder specifications.
Check the encoder specifications selection switch (FR-A7AP/FR-A7AL (option)) of differential/ complementary</td></tr>
<tr><td>(3) The encoder wiring is wrong.</td><td>(3) Check that FWD is displayed when running the motor in the counter-clockwise direction from outside during a stop of the inverter with vector control setting.
If REV is displayed, the encoder phase sequence is wrong.
Perform the correct wiring or match the Pr. 359 Encoder rotation direction.
<table><tr><th>Pr. 359 Setting</th><th>Relationship between the Motor and Encoder</th></tr><tr><td>0</td><td> 

Clockwise direction as viewed from A is forward rotation</td></tr><tr><td>1
(Initial value)</td><td> 

Counter clockwise direction as viewed from A is forward rotation</td></tr></table></td></tr>
<tr><td>(4) The Pr. 369 Number of encoder pulses setting and the number of encoder used are different.</td><td>(4) The motor will not run if the parameter setting is smaller than the number of encoder pulses used. Set the Pr. 369 Number of encoder pulses correctly.</td></tr>
<tr><td>(5) Encoder power specifications are wrong. Or, power is not input.</td><td>(5) Check the power specifications (5V/12V/15V/24V) of encoder and input the external power supply.</td></tr>
<tr><td>2</td><td>Motor does not run at correct speed. (Speed command does not match actual speed)</td><td>(1) The speed command from the command device is incorrect. The speed command is compounded with noise.
(2) The speed command value does not match the inverter-recognized value.
(3) The number of encoder pulses setting is incorrect.</td><td>(1) Check that a correct speed command comes from the command device.
Decrease Pr. 72 PWM frequency selection.
(2) Readjust speed command bias/gain Pr. 125, Pr. 126, C2 to C7 and C12 to C15.
(3) Check the setting of Pr. 369 Number of encoder pulses. (vector control)</td></tr>
<tr><td>3</td><td>Speed does not rise to the speed command.</td><td>(1) Insufficient torque. Torque limit is actuated.
(2) Only P (proportional) control is selected.</td><td>(1) -1 Increase the torque limit value.
(Refer to torque limit of speed control on Chapter 4 of 📖 the Instruction Manual (Applied))
(1) -2 Insufficient capacity
(2) When the load is heavy, speed deviation will occur under P (proportional) control. Select PI control.</td></tr>
</table>

	Phenomenon	Cause	Countermeasures
4	Motor speed is unstable.	(1) The speed command varies.	(1) -1 Check that a correct speed command comes from the command device. (Take measures against noises.) (1) -2 Decrease *Pr. 72 PWM frequency selection*. (1) -3 Increase *Pr. 822 Speed setting filter 1*. *(Refer to Chapter 4 of the Instruction Manual (Applied))*
		(2) Insufficient torque.	(2) Increase the torque limit value. (Refer to torque limit of speed control on *Chapter 4 of the Instruction Manual (Applied)*)
		(3) The speed control gains do not match the machine. (mechanical resonance)	(3) -1 Perform easy gain tuning. *(Refer to page 77)* (3) -2 Adjust *Pr. 820, Pr. 821*. *(Refer to page 79)* (3) -3 Perform speed feed forward/model adaptive speed control.
5	Motor or machine hunts (vibration/noise is produced).	(1) The speed control gain is high.	(1) -1 Perform easy gain tuning. *(Refer to page 77)* (1) -2 Decrease *Pr. 820* and increase *Pr. 821*. (1) -3 Perform speed feed forward control and model adaptive speed control.
		(2) The torque control gain is high.	(2) Decrease the *Pr. 824* value.
		(3) The motor wiring is wrong.	(3) Check the wiring
6	Acceleration/deceleration time does not match the setting.	(1) Insufficient torque.	(1) -1 Increase the torque limit value. (Refer to torque limit of speed control on *Chapter 4 of the Instruction Manual (Applied)*) (1) -2 Perform speed feed forward control.
		(2) Large load inertia.	(2) Set the acceleration/deceleration time that meets the load.
7	Machine operation is unstable.	(1) The speed control gains do not match the machine.	(1) -1 Perform easy gain tuning. *(Refer to page 77)* (1) -2 Adjust *Pr. 820, Pr. 821*. *(Refer to page 79)* (1) -3 Perform speed feed forward control and model adaptive speed control.
		(2) Slow response because of improper acceleration/ deceleration time of the inverter.	(2) Change the acceleration/deceleration time to an optimum value.
8	Speed fluctuates at low speed.	(1) Adverse effect of high carrier frequency.	(1) Decrease *Pr. 72 PWM frequency selection*.
		(2) Low speed control gain.	(2) Increase *Pr. 820 Speed control P gain 1*.

4.4 Start/stop from the operation panel (PU operation mode)

POINT

From where is the frequency command given?

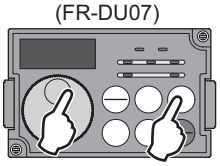
- **Operation at the frequency set in the frequency setting mode of the operation panel** →*Refer to 4.4.1 (Refer to page 83)*
- **Operation using the setting dial as the potentiometer** →*Refer to 4.4.2 (Refer to page 85)*
- **Change of frequency with ON/OFF switches connected to terminals** →*Refer to 4.4.3 (Refer to page 86)*
- **Frequency setting with a voltage output device** →*Refer to 4.4.4 (Refer to page 88)*
- **Frequency setting with a current output device** →*Refer to 4.4.5 (Refer to page 90)*

4.4.1 Setting the set frequency to operate (example: performing operation at 30Hz)

POINT

Operation panel (FR-DU07) is used to give both of frequency and start commands in PU operation.

Operation panel
(FR-DU07)



Operation example | Performing operation at 30Hz.

Operation

1. Screen at power-ON
   The monitor display appears.

2. Press (PU/EXT) to choose the PU operation mode.

3. Turn  to show the frequency "30.00" (30.00Hz) you want to set.
   The frequency flickers for about 5s.

4. While the value is flickering, press (SET) to set the frequency.

   If you do not press (SET), the value flickers for about 5s and the display then returns to "0.00" (0.00Hz).
   At this time, return to "Step 3" and set the frequency again.
   After the value flickered for about 3s, the display returns to "0.00" (monitor display).

5. Start→acceleration→constant speed
   Press (FWD) or (REV) to start running.
   The frequency on the display increases in *Pr.7 Acceleration time*, and "30.00" (30.00Hz) appears.

6. To change the set frequency, perform the operation in above steps 3 and 4.
   (Starting from the previously set frequency.)

7. Deceleration → Stop
   Press (STOP/RESET) to stop.
   The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed.

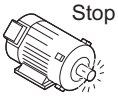
Display

PU indicator is lit.

Flicker ··· Frequency setting complete!!

After 3s, the monitor display appears.

Stop



? Operation cannot be performed at the set frequency ... Why?

☞ Did you carry out step 4 within 5s after step 3? (Did you press (SET) within 5s after turning ◎ ?)

? The frequency does not change by turning ◎ ... Why?

☞ Check to see if the operation mode selected is External operation mode. (Press (PU/EXT) to change to PU operation mode.)

? Operation does not change to the PU operation mode ... Why?

☞ Check that "0" (initial value) is set in *Pr. 79 Operation mode selection*.

☞ Check that the start command is not on.

? Change acceleration time ☞*Pr. 7 (Refer to page 61)*

? Change deceleration time ☞*Pr. 8 (Refer to page 61)*

For example, limit the motor speed to 60Hz maximum. ☞Set "60Hz" in *Pr. 1. (Refer to page 60)*

REMARKS

· Press ◎ to show the set frequency. 

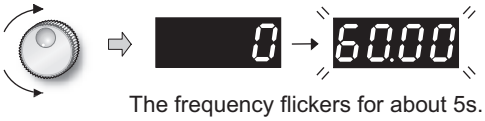
· ◎ can also be used like a potentiometer to perform operation. *(Refer to page 85)*

4.4.2 Use the setting dial like a potentiometer to perform operation.

POINT

Set "1" (setting dial potentiometer mode) in *Pr. 161 Frequency setting/key lock operation selection*.

Operation example | Change the frequency from 0Hz to 60Hz during operation

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press (PU/EXT) to choose PU operation mode.	(PU/EXT) ⇨ PU indicator is lit. 
3. Change *Pr. 161* to the setting value " 1 ". *(Refer to page 52 for change of the setting.)*	
4. Press (FWD) (or (REV)) to start the inverter.	(FWD) ⇨ 
5. Turn dial until "60.00" appears. The flickering frequency is the set frequency. You need not press (SET).	 The frequency flickers for about 5s.

REMARKS

- If flickering "60.00" turns to "0.0", the *Pr. 161 Frequency setting/key lock operation selection* setting may not be "1".
- Independently of whether the inverter is running or at a stop, the frequency can be set by merely turning dial.

CAUTION

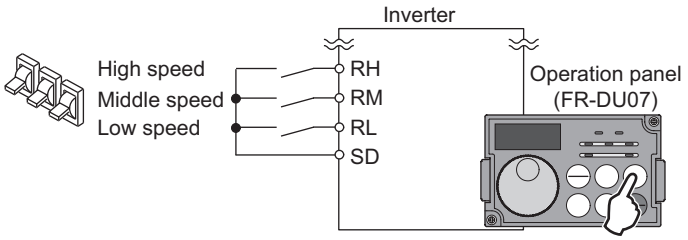
- When using setting dial, the frequency goes up to the set value of *Pr. 1 Maximum frequency* (initial value is 120Hz). Adjust *Pr. 1 Maximum frequency* setting according to the application.

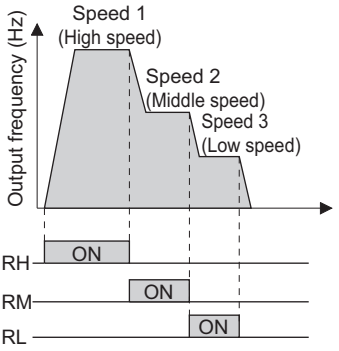
4.4.3 Setting the frequency by switches (three-speed setting)

POINT

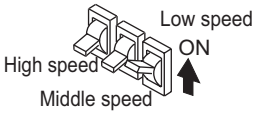
- Use the operation panel (FR-DU07) (FWD or REV) to give a start command.
- Switch ON the RH, RM, or RL signal to give a frequency command. (Three-speed setting)
- Set "4" (External/PU combined operation mode 2) in *Pr. 79 Operation mode selection*.

[Connection diagram]





Operation example | Operation at low speed (10Hz)

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press (MODE) to choose the parameter setting mode.	(MODE) ⇨  The parameter number read previously appears.
3. Turn dial until P. 79 (*Pr. 79*) appears.	
4. Press (SET) to read the present set value. "0"(initial value) appears.	(SET) ⇨ 
5. Turn dial to change it to the setting value "4".	
6. Press (SET) to set.	(SET) ⇨  **Flicker ··· Parameter setting complete!!**
7. Mode/monitor check Press (MODE) twice to change to monitor / frequency monitor. [PU] indicator and [EXT] indicator are lit.	(MODE) ⇨ 
8. Start Turn ON the low-speed switch (RL).	

Operation — Display

9. Acceleration → constant speed

Press (FWD) or (REV) to start running.

The frequency on the display increases in *Pr.7 Acceleration time*, and "10.00" (10.00Hz) appears.

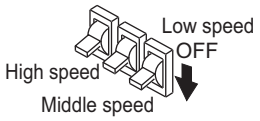
10. Deceleration

Press (STOP RESET) to stop.

The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed.

11. STOP

Turn OFF the low-speed switch (RL).



? 60Hz for the RH, 30Hz for the RM and 10Hz for the RL are not output when they are turned ON ... Why?

☞ Check for the setting of *Pr. 4*, *Pr. 5*, and *Pr. 6* once again.

☞ Check for the setting of *Pr. 1 Maximum frequency* and *Pr. 2 Minimum frequency* once again. *(Refer to page 60.)*

☞ Check that *Pr. 180 RL terminal function selection* = "0", *Pr. 181 RM terminal function selection* = "1", *Pr. 182 RH terminal function selection* = "2" and *Pr. 59 Remote function selection* = "0". (all are initial values)

? [FWD (or REV)] lamp is not lit ... Why?

☞ Check that wiring is correct. Check the wiring once again.

☞ Check for the *Pr. 79* setting once again. (*Pr. 79* must be set to "4".) *(Refer to page 62.)*

? Change the frequency of the terminals RL, RM, and RH. ... How?

☞ Refer to *page 94* to change the running frequency at each terminal in *Pr. 4 Multi-speed setting (high speed)*, *Pr. 5 Multi-speed setting (middle speed)*, and *Pr. 6 Multi-speed setting (low speed)*.

REMARKS

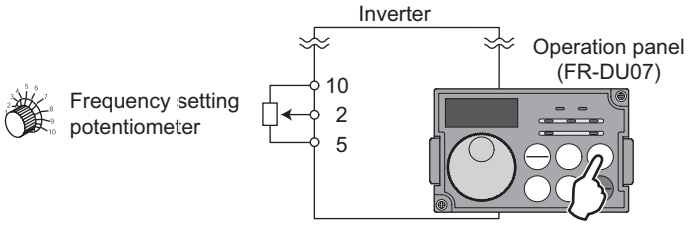
- Initial values of terminals RH, RM, and RL are 60Hz, 30Hz, and 10Hz. (To change, set *Pr. 4*, *Pr. 5*, and *Pr. 6*.)
- In the initial setting, when two or more of multi-speed settings are simultaneously selected, priority is given to the set frequency of the lower signal. For example, when RH and RM signals turn ON, RM signal (*Pr. 5*) has a higher priority.
- Maximum of 15-speed operation can be performed. *(Refer to the Chapter 4 of the Instruction Manual (Applied).)*

4.4.4 Setting the frequency by analog input (voltage input)

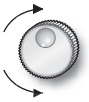
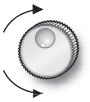
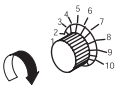
POINT

- Use the operation panel (FR-DU07) (FWD or REV) to give a start command.
- Use the (frequency setting) potentiometer to give a frequency command.
  (Connect terminals 2 and 5 to input a voltage.)
- Set "4" (External/PU combined operation mode 2) in *Pr. 79 Operation mode selection*.

[Connection diagram]
(The inverter supplies 5V of power to the frequency setting potentiometer.(Terminal 10))



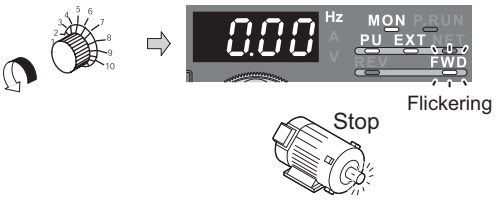
Operation example | Performing operation at 60Hz.

Operation	Display
1. Screen at powe-ON The monitor display appears.	
2. Press MODE to choose the parameter setting mode.	MODE ⇨  (The parameter number read previously appears.)
3. Turn dial until P. 79 (*Pr. 79*) appears.	 ⇨ 
4. Press SET to read the present set value. "0"(initial value) appears.	SET ⇨ 
5. Turn dial to change it to the setting value "4".	 ⇨ 
6. Press SET to set.	SET ⇨  **Flicker ··· Parameter setting complete!!**
7. Mode/monitor check Press MODE twice to choose the monitor/frequency monitor. [PU] indicator and [EXT] indicator are lit.	MODE ⇨ 
8. Start Press FWD or REV. [FWD] or [REV] is flickering as no frequency command is given.	FWD / REV ⇨  Flickering
9. Acceleration → constant speed Turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. The frequency value on the display increases in *Pr. 7 Acceleration time,* and "60.00"(60Hz) appears.	 ⇨ 

Operation

Display

10. Deceleration
Turn the potentiometer (frequency setting potentiometer) counterclockwise slowly to full. The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed. [FWD] indicator or [REV] indicator flickers.



11. Stop
Press STOP/RESET.
[FWD] indicator or [REV] indicator turns OFF.

? Change the frequency (60Hz) of the maximum value of potentiometer (at 5V, initial value)
☞ Adjust the frequency in *Pr. 125 Terminal 2 frequency setting gain frequency. (Refer to page 97.)*

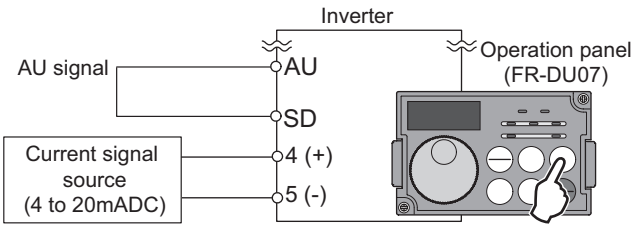
? Change the frequency (0Hz) of the minimum value of potentiometer (at 0V, initial value)
☞ Adjust the frequency in *calibration parameter C2 Terminal 2 frequency setting bias frequency. (Refer to Chapter 4 of the Instruction Manual (Applied).)*

4.4.5 Setting the frequency by analog input (current input)

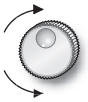
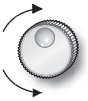
POINT

- Use the operation panel (FR-DU07) ((FWD) or (REV)) to give a start command.
- Input a current to give a frequency command. (Connect terminals 4 and 5 to input a current.)
- Switch ON the AU signal.
- Set "4" (External/PU combined operation mode 2) in *Pr. 79 Operation mode selection*.

[Connection diagram]



Operation example | Performing operation at 60Hz.

Operation		Display
1. Screen at power-ON The monitor display appears.		
2. Press (MODE) to choose the parameter setting mode.	(MODE) ⇨	 (The parameter number read previously appears.)
3. Turn dial until P. 79 (*Pr. 79*) appears.	 ⇨	
4. Press (SET) to read the present set value. "0"(initial value) appears.	(SET) ⇨	
5. Turn dial to change it to the setting value "4".	 ⇨	
6. Press (SET) to set.	(SET) ⇨	 **Flicker ··· Parameter setting complete!!**
7. Mode/monitor check Press (MODE) twice to choose the monitor/frequency monitor. [PU] indicator and [EXT] indicator are lit.	(MODE) ⇨	
8. Start Check that the terminal 4 input selection signal (AU) is on. Press (FWD) or (REV). [FWD] or [REV] is flickering as no frequency command is given.	(FWD)/(REV) ⇨	 Flickering

Operation	Display
9. Acceleration → constant speed Perform 20mA input. The frequency on the display increases in *Pr. 7 Acceleration time* and "60.00" (60.00Hz) appears.	Current signal source (20mADC) → 
10. Deceleration Input 4mA or less. The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed. [FWD] indicator or [EXT] indicator flickers.	Current signal source (4mADC) →  Flickering  Stop
11. Stop Press STOP/RESET. [FWD] indicator or [REV] indicator turns OFF.	STOP/RESET → 

REMARKS

Pr. 184 AU terminal function selection must be set to "4" (AU signal) (initial value). *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

? Change the frequency (60Hz) at the maximum value of potentiometer (at 20mA, initial value)
☞ Adjust the frequency in *Pr. 126 Terminal 4 frequency setting gain frequency. (Refer to page 99.)*

? Change the frequency (0Hz) at the minimum value of potentiometer (at 4mA, initial value)
☞ Adjust the frequency in *calibration parameter C5 Terminal 4 frequency setting bias frequency. (Refer to Chapter 4 of the Instruction Manual (Applied).)*

4.5 Start and stop using terminals (External operation)

POINT

From where is the frequency command given?

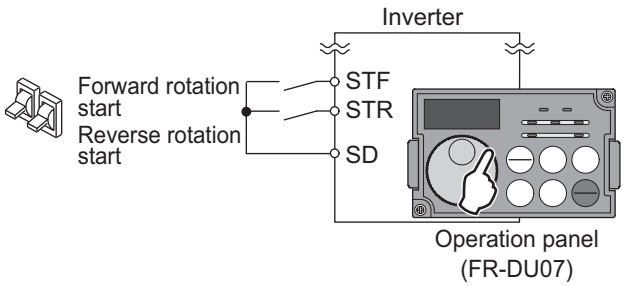
- **Operation at the frequency set in the frequency setting mode of the operation panel** → *Refer to 4.5.1(Refer to page 92)*
- **Give a frequency command by switch (multi-speed setting)** → *Refer to 4.5.2 (Refer to page 94)*
- **Perform frequency setting by a voltage output device** → *Refer to 4.5.3 (Refer to page 96)*
- **Perform frequency setting by a current output device** → *Refer to 4.5.5 (Refer to page 98)*

4.5.1 Setting the frequency by the operation panel (Pr. 79 = 3)

POINT

- Switch ON the STF(STR) signal to give a start command.
- Use the operation panel (FR-DU07) ( ) to give a frequency command.
- Set "3" (External/PU combined operation mode 1) in *Pr. 79 Operation mode selection*.

[Connection diagram]



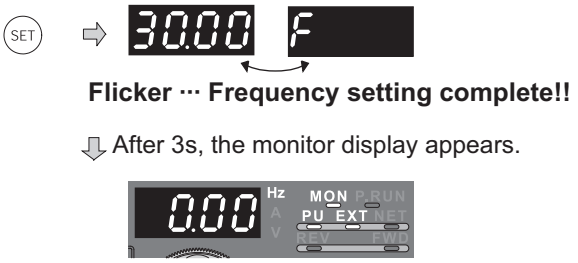
Operation example | Performing operation at 30Hz.

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Press (PU/EXT) to choose the PU operation mode.	(PU/EXT) ⇨ PU indicator is lit. 
3. Press (MODE) to choose the parameter setting mode.	(MODE) ⇨ P. 0 (The parameter number read previously appears.)
4. Turn dial until P. 79 (*Pr. 79*) appears.	⇨ P. 79
5. Press (SET) to read the present set value. "0"(initial value) appears.	(SET) ⇨ 0
6. Turn dial to change it to the setting value "3".	⇨ 3
7. Press (SET) to set.	(SET) ⇨ P. 79 3 **Flicker ··· Parameter setting complete!!**
8. Mode/monitor check Press (MODE) twice to choose the monitor/frequency monitor. [PU] indicator and [EXT] indicator are lit.	(MODE) 

Operation — Display

9. Turn to show the selected frequency, "30.00" (30.00Hz).
The frequency flickers for about 5s.

10. While the value is flickering, press (SET) to set the frequency.
If you do not press (SET), the value flickers for about 5s and the display then returns to 0.00 (display) Hz.
At this time, return to "Step 8" and set the frequency again.
After about 3s of flickering of the value, the display goes back to "0.00" (monitor display).



11. Start → acceleration → constant speed
Turn ON the start switch (STF or STR).
The frequency on the display increases in *Pr.7 Acceleration time*, and "30.00" (30.00Hz) appears.
[FWD] indicator is lit during forward rotation, and [REV] indicator is lit during reverse rotation.

CAUTION
When both of STF and STR signals are turned ON, the motor cannot start.
If both are turned ON while the motor is running, the motor decelerates to a stop.

12. To change the set frequency, perform the operation in above steps 9 and 10.
(Starting from the previously set frequency.)

13. Deceleration → Stop
Turn OFF the start switch (STF or STR).
The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed.

REMARKS

- *Pr. 178 STF terminal function selection* must be set to "60" (or *Pr. 179 STR terminal function selection* must be set to "61"). (all are initial values)
- When *Pr. 79 Operation mode selection* is set to "3", multi-speed operation (refer to *page 94*) is also valid.

? When the inverter is stopped by (STOP RESET) of the operation panel (FR-DU07), PS and 0.00 Hz MON PU EXT FWD (Flickering) are displayed alternately.

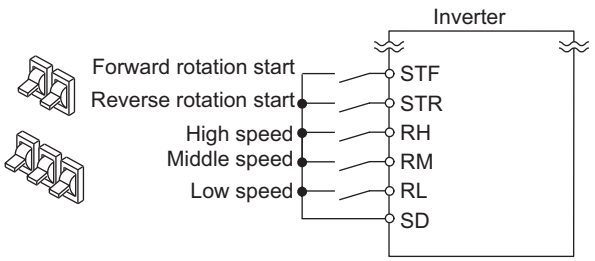
☞ 1. Turn the start switch (STF or STR) OFF.
2. The display can be reset by (PU EXT).

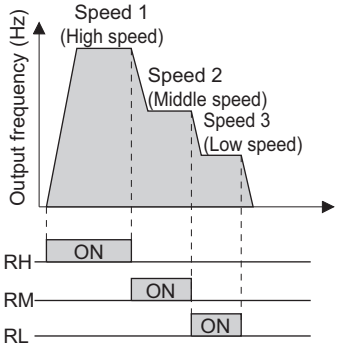
4.5.2 Setting the frequency by switches (three-speed setting) (Pr. 4 to Pr. 6)

POINT

- Switch ON the STF (STR) signal to give a start command.
- Switch ON the RH, RM, or RL signal to give a frequency command.
- [EXT] must be lit. (When [PU] is lit, switch it to [EXT] with (PU/EXT).)
- The initial values of the terminals RH, RM and RL are 60Hz, 30Hz, and 10Hz. (Use *Pr. 4*, *Pr. 5 and Pr. 6* to change.)
- Operation at 7-speed can be performed by turning two (or three) terminals simultaneously. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

[Connection diagram]

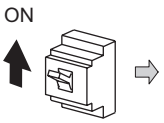




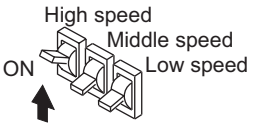
Changing example | Operation at high speed (60Hz).

Operation

1. Screen at power-ON
   The monitor display appears.

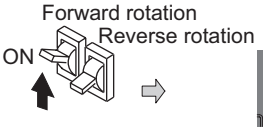


2. Turn ON the high-speed switch (RH).

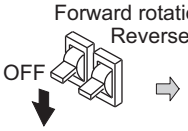


3. Acceleration → constant speed
   Turn ON the start switch (STF or STR). The frequency on the display increases in *Pr. 7 Acceleration time*, and "60.00" (60.00Hz) appears.
   [FWD] indicator is lit during forward rotation, and [REV] indicator is lit during reverse rotation.
   ●When RM is turned ON, 30Hz is displayed.
   When RL is turned ON, 10Hz is displayed.

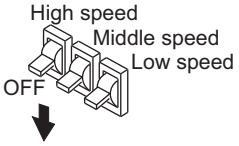
CAUTION
When both of STF and STR signals are turned ON, the motor cannot start.
If both are turned ON while the motor is running, the motor decelerates to a stop.



4. Turn OFF the start switch (STF or STR).
   The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed.
   [FWD] indicator or [REV] indicator turns OFF.



5. Stop
   Turn OFF the high-speed switch (RH).



? [EXT] is not lit even when (PU/EXT) is pressed ... Why?

☞ Switchover of the operation mode with (PU/EXT) is valid when *Pr. 79* = "0" (initial value).

? 50Hz, 30Hz and 10Hz are not output from RH, RM and RL respectively when they are turned ON. ... Why?

☞ Check for the setting of *Pr. 4*, *Pr. 5*, *and Pr. 6* once again.

☞ Check for the setting of *Pr. 1 Maximum frequency* and *Pr. 2 Minimum frequency* once again. *(Refer to page 60)*

☞ Check for the *Pr. 79* setting once again. (*Pr. 79* must be set to "0" or "2".) *(Refer to page 62)*

☞ Check that *Pr. 180 RL terminal function selection* = "0", *Pr. 181 RM terminal function selection* = "1", *Pr. 182 RH terminal function selection* = "2" and *Pr. 59 Remote function selection* = "0". (All are initial values.)

? [FWD (or REV)] is not lit. ... Why?

☞ Check that wiring is correct. Check it again.

☞ Check that "60" is set in *Pr. 178 STF terminal function selection* (or "61" is set in *Pr. 179 STR terminal function selection)*?
(All are initial values.)

? How is the frequency setting from 4 to 7 speed ?

☞ In the initial setting, when two or more of multi-speed settings are simultaneously selected, priority is given to the set frequency of the lower signal. For example, when RH and RM signals turn ON, the RM signal (*Pr. 5*) has a higher priority. By setting *Pr. 24* to *Pr. 27* (multi-speed setting), up to 7- speed can be set by combinations of RH, RM, and RL signals. *Refer to the Chapter 4 of the Instruction Manual (Applied).*

? Perform multi-speed operation more than 8 speed. ... How?

☞ Use the REX signal to perform the operation. Maximum of 15-speed operation can be performed. *Refer to Chapter 4 of the Instruction Manual (Applied).*

REMARKS

· External operation is fixed by setting "2" (External operation mode) in *Pr. 79 Operation mode selection* when you do not want to take time pressing (PU/EXT) or when you want to use the current start command and frequency command. *(Refer to page 62)*

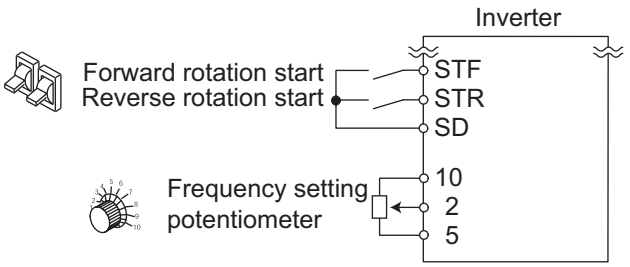
4.5.3 Setting the frequency by analog input (voltage input)

POINT

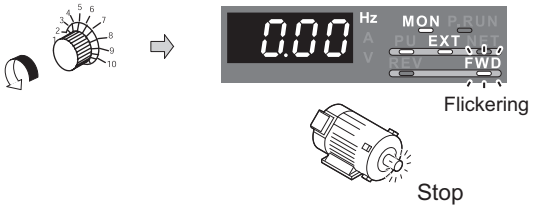
- Switch ON the STF(STR) signal to give a start command.
- Use the potentiometer (frequency setting potentiometer) to give a frequency command. (Connect terminals 2 and 5 to input a voltage.)

[Connection diagram]

(The inverter supplies 5V of power to frequency setting potentiometer. (Terminal 10))



Operation example | Performing operation at 60Hz.

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Start Turn ON the start switch (STF or STR). [FWD] or [REV] is flickering as no frequency command is given. **CAUTION** **When both of STF and STR signals are turned ON, the motor cannot start.** **If both are turned ON while the motor is running, the motor decelerates to a stop.**	
3. Acceleration → constant speed Turn the potentiometer (frequency setting potentiometer) clockwise slowly to full. The frequency on the display increases in *Pr.7 Acceleration time*, and "60.00" (60.00Hz) appears. [FWD] indicator is lit during forward rotation, and [REV] indicator is lit during reverse rotation.	
4. Deceleration Turn the potentiometer (frequency setting potentiometer) counterclockwise slowly to full. The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed. [FWD] indicator or [EXT] indicator flickers.	
5. Stop Turn the start switch (STF or STR) OFF. [FWD] indicator or [REV] indicator turns OFF.	

When you want to operate in External operation mode always at power-ON or when you want to save the trouble of (PU/EXT) input, set "2" (External operation mode) in Pr. 79 Operation mode selection to choose External operation mode always.

REMARKS

Pr. 178 STF terminal function selection must be set to "60" (or *Pr. 179 STR terminal function selection* must be set to "61").
(all are initial values)

? The motor will not rotate ... Why?

☞ Check that [EXT] is lit.
[EXT] is valid when *Pr. 79* = "0" (initial value) or "2".

Use (PU/EXT) to lit [EXT].

☞ Check that wiring is correct. Check once again.

? Change the frequency (0Hz) at the minimum voltage input (at 0V, initial value)

☞Adjust the frequency in *calibration parameter C2 Terminal 2 frequency setting bias frequency*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

When you want to compensate frequency setting, use terminal 1.
For details, refer to *Chapter 4 of the Instruction Manual (Applied)*.

4.5.4 Changing the frequency (60Hz, initial value) at the maximum voltage input (5V, initial value)

<How to change the maximum frequency>

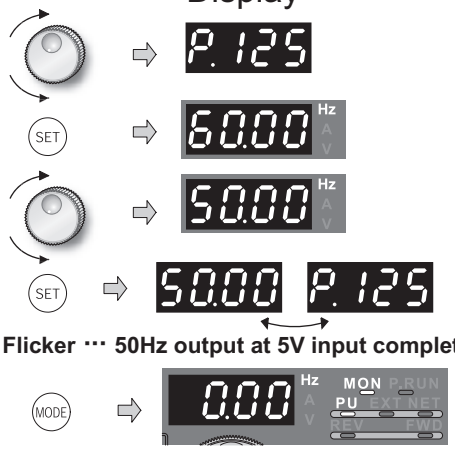
Changing example

When you want to use the 0 to 5VDC input frequency setting potentiometer to change the frequency at 5V from 60Hz (initial value) to 50Hz
Adjust to output 50Hz at 5V voltage input.
Set "50Hz" in *Pr. 125*.

Operation

1. Turn the dial until P.125 (*Pr. 125*) appears.
2. Press SET to show the present set value. (60.00Hz)
3. Turn the dial to change the set value to "50.00". (50.00Hz).
4. Press SET to set.
5. Mode/monitor check
   Press MODE twice to choose the monitor/frequency monitor.
6. Turn the start switch (STF or STR) on and turn the potentiometer (frequency setting potentiometer) clockwise to full slowly.
   (Refer to 4.5.3 steps 2 to 5)

Display

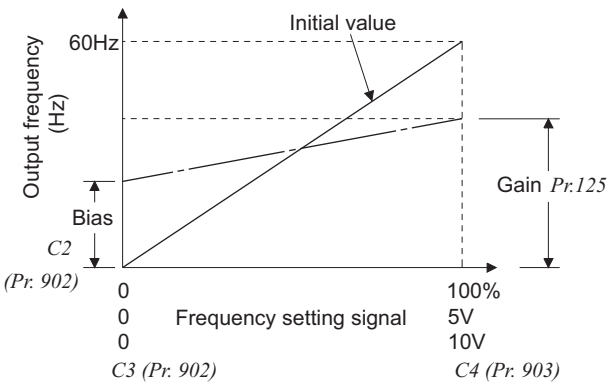


? The frequency meter (indicator) connected across terminals FM and SD does not indicate exactly 50Hz ... Why?

☞ The meter can be adjusted by *calibration parameter C0 FM terminal calibration*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

? Set frequency at 0V using *calibration parameter C2* and adjust the indicator using *calibration parameter C0*.

(Refer to Chapter 4 of the Instruction Manual (Applied).)



REMARKS

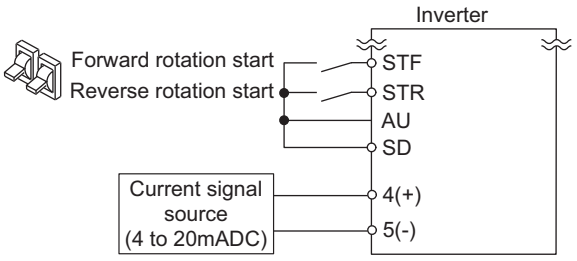
As other adjustment methods of frequency setting voltage gain, there are methods to adjust with a voltage applied to across terminals 2 and 5 and adjust at any point without a voltage applied.
(Refer to *Chapter 4 of the Instruction Manual (Applied)* for the setting method of *calibration parameter C4*.)

4.5.5 Setting the frequency by analog input (current input)

POINT

- Switch ON the STF (STR) signal to give a start command.
- Switch ON the AU signal.
- Set "2" (External operation mode) in *Pr. 79 Operation mode selection*.

[Connection diagram]



Operation

1. Screen at power-ON
   The monitor display appears.

2. Start
   Check that the terminal 4 input selection signal (AU) is ON.
   Turn the start switch (STF or STR) ON.
   [FWD] or [REV] is flickering as no frequency command is given. *(Refer to page 62.)*

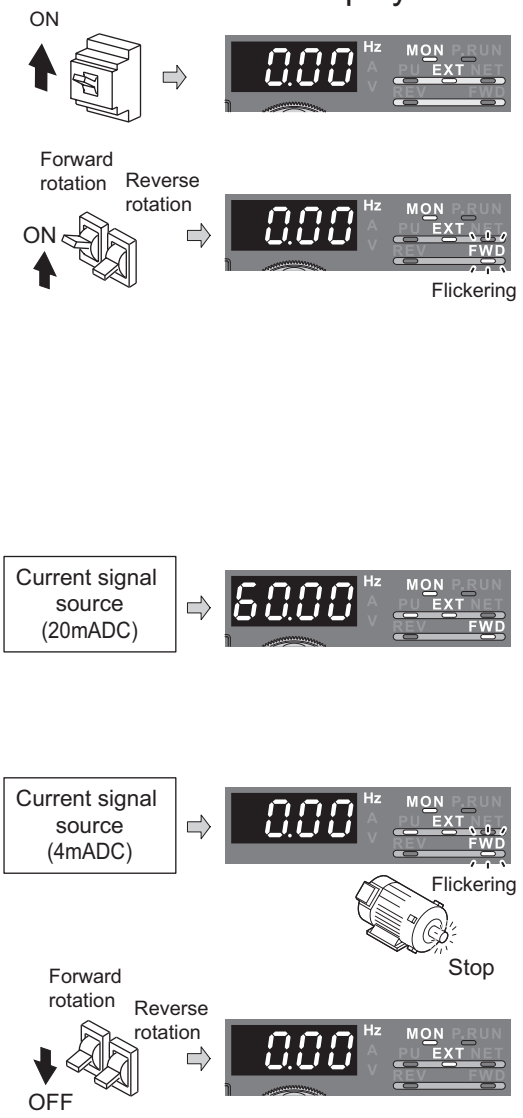
CAUTION
When both of STF and STR signals are turned ON, the motor cannot start.
If both are turned ON while the motor is running, the motor decelerates to a stop.

3. Acceleration → constant speed
   Perform 20mA input.
   The frequency on the display increases in *Pr.7 Acceleration time*, and "60.00" (60.00Hz) appears.
   [FWD] indicator is lit during forward rotation, and [REV] indicator is lit during reverse rotation.

4. Deceleration
   Input 4mA or less.
   The frequency on the display decreases in *Pr. 8 Deceleration time*, and the motor stops rotating with "0.00" (0.00Hz) displayed.
   [FWD] indicator or [EXT] indicator flickers.

5. Stop
   Turn the start switch (STF or STR) OFF.
   [FWD] indicator or [REV] indicator turns OFF.

Display



REMARKS

Pr. 184 AU terminal function selection must be set to "4" (AU signal) (initial value). *(Refer to Chapter 4 of the Instruction Manual (Applied).)*

? The motor will not rotate ... Why?

☞ Check that [EXT] is lit.
[EXT] is valid when *Pr. 79* = "0" (initial value) or "2".

Use (PU/EXT) to lit [EXT].

☞ Check that the AU signal is ON.
Turn the AU signal ON.

☞ Check that wiring is correct. Check it again.

? Change the frequency (0Hz) at the minimum current input (at 4mA, initial value)

☞ Adjust the frequency in *calibration parameter C5 Terminal 4 frequency setting bias frequency*.
(Refer to Chapter 4 of the Instruction Manual (Applied).)

4.5.6 Changing the frequency (60Hz, initial value) at the maximum current input (at 20mA, initial value)

<How to change the maximum frequency?>

Changing example

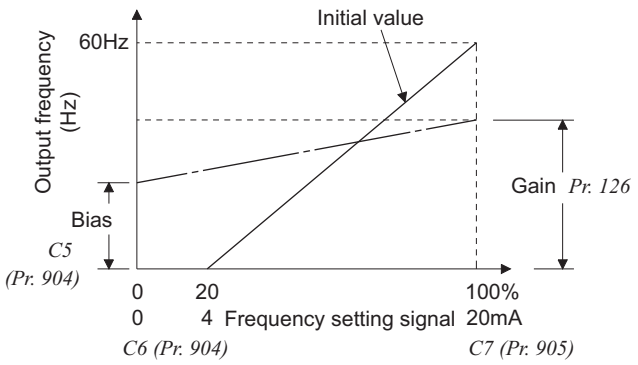
When you want to use the 4 to 20mA input frequency setting potentiometer to change the 20mA-time frequency from 60Hz (initial value) to 50Hz
Adjust to output 50Hz at 20mA current input.
Set "50Hz" in *Pr. 126*.

Operation	Display
1. Turn until P.126 (*Pr. 126*) appears.	P.126
2. Press (SET) to show the currently set value. (60.00Hz)	60.00 Hz
3. Turn to change the set value to "50.00". (50.00Hz)	50.00 Hz
4. Press (SET) to set the value.	50.00 ⇔ P.126
	Flicker ··· 50Hz output at 20mA input complete!!
5. Mode/monitor check Press (MODE) twice to choose the monitor/frequency monitor.	0.00 Hz MON P.RUN PU EXT NET REV FWD
6. Turn the start switch (STF or STR) ON to allow 20mA current to flow. (Refer to 4.5.5 steps 2 to 5)	

? The frequency meter (indicator) connected across terminals FM and SD does not indicate exactly 50Hz ... Why?

☞ The meter can be adjusted by *calibration parameter C0 FM terminal calibration*.
(Refer to Chapter 4 of the Instruction Manual (Applied).)

? Set frequency at 4mA using *calibration parameter C5* and adjust the indicator using *calibration parameter C0*.
(Refer to Chapter 4 of the Instruction Manual (Applied).)



REMARKS

As other adjustment methods of frequency setting voltage gain, there are methods to adjust with a voltage applied to across terminals 4 and 5 and adjust at any point without a voltage applied.
(Refer to *Chapter 4 of the Instruction Manual (Applied)* for the setting method of *calibration parameter C7*.)

4.6 Parameter List

4.6.1 List of parameters classified by the purpose

This Instruction Manual provides basic explanation of parameters. For parameters not stated, refer to *the Chapter 4 Parameter of the Instruction Manual (Applied)*.
Set the parameters according to the operating conditions. The following list indicates purpose of use and corresponding parameters.

Purpose of Use		Parameter Number
Control mode	Change the control method	Pr. 80, Pr. 81, Pr. 451, Pr. 800
Speed control by Real sensorless vector control and vector control	Torque limit level setting for speed control	Pr. 22, Pr. 803, Pr. 810 to Pr. 817, Pr. 858, Pr. 868, Pr. 874
	To perform high accuracy/fast response operation (gain adjustment of Real sensorless vector control and vector control)	Pr. 818 to Pr. 821, Pr. 830, Pr. 831, Pr. 880
	Speed feed forward control, model adaptive speed control	Pr. 828, Pr. 877 to Pr. 881
	Torque bias function	Pr. 840 to Pr. 848
	Prevent the motor from overrunning	Pr. 285, Pr. 853, Pr. 873
	Notch filter	Pr. 862, Pr. 863
Torque control by Real sensorless vector control and vector control	Torque command	Pr. 803 to Pr. 806
	Speed limit	Pr. 807 to Pr.809
	Gain adjustment for torque control	Pr. 824, Pr. 825, Pr. 834, Pr. 835
Position control by vector control	Simple position feed function by contact input	Pr. 419, Pr. 464 to Pr. 494
	Position control by pulse train input of the inverter	Pr. 419, Pr. 428 to Pr. 430
	Setting the electronic gear	Pr. 420, Pr. 421, Pr. 424
	Setting of positioning adjustment parameter	Pr. 426, Pr. 427
	Gain adjustment of position control	Pr. 422, Pr. 423, Pr. 425
Adjust the output torque of the motor (current)	Manual torque boost	Pr. 0, Pr. 46, Pr. 112
	Advanced magnetic flux vector control	Pr. 80, Pr. 81, Pr. 89, Pr. 453, Pr. 454, Pr. 569
	Real sensorless vector control	Pr. 80, Pr. 81, Pr. 451, Pr. 800
	Slip compensation	Pr. 245 to Pr. 247
	Stall prevention operation	Pr. 22, Pr. 23, Pr. 48, Pr. 49, Pr. 66, Pr. 114, Pr. 115, Pr. 148, Pr. 149, Pr. 154, Pr. 156, Pr. 157, Pr. 858, Pr. 868
	Torque limit	Pr. 22, Pr. 803, Pr. 810, Pr. 812 to Pr. 817, Pr. 858, Pr. 868, Pr. 874
Limit the output frequency	Maximum/minimum frequency	Pr. 1, Pr. 2, Pr. 18
	Avoid mechanical resonance points (frequency jump)	Pr. 31 to Pr. 36
	Speed limit	Pr. 807 to Pr. 809
Set V/F pattern	Base frequency, voltage	Pr. 3, Pr. 19, Pr. 47, Pr. 113
	V/F pattern matching applications	Pr. 14
	Adjustable 5 points V/F	Pr. 71, Pr. 100 to Pr. 109
Frequency setting with terminals (contact input)	Multi-speed setting operation	Pr. 4 to Pr. 6, Pr. 24 to Pr. 27, Pr. 232 to Pr. 239
	Jog operation	Pr. 15, Pr. 16
	Input compensation of multi-speed and remote setting	Pr. 28
	Remote setting function	Pr. 59

Purpose of Use		Parameter Number
Acceleration/deceleration time/pattern adjustment	Acceleration/deceleration time setting	Pr. 7, Pr. 8, Pr. 20, Pr. 21, Pr. 44, Pr. 45, Pr. 110, Pr. 111
	Starting frequency	Pr. 13, Pr. 571
	Acceleration/deceleration pattern and backlash measures	Pr. 29, Pr. 140 to Pr. 143, Pr.380 to Pr. 383, Pr. 516 to Pr. 519
	Set a shortest and optimum acceleration/deceleration time automatically. (Automatic acceleration/deceleration)	Pr. 61 to Pr. 64, Pr. 292, Pr. 293
	Regeneration avoidance functions at deceleration	Pr. 882 to Pr.886, Pr.665
Selection and protection of a motor	Motor protection from overheat (electronic thermal relay function)	Pr. 9, Pr. 51
	Use the constant-torque motor (applied motor)	Pr. 71, Pr. 450
	Offline auto tuning	Pr. 82 to Pr. 84, Pr. 90 to Pr. 94, Pr. 96, Pr. 455 to Pr. 463, Pr. 684, Pr. 859, Pr. 860
	Online auto tuning	Pr. 95, Pr. 574
	Easy gain tuning	Pr. 818, Pr. 819
Motor brake and stop operation	DC injection brake, Magnetic flux decay output shutoff	Pr. 10 to Pr. 12, Pr. 850
	Selection of motor stopping method	Pr. 250
	Decelerate the motor to a stop at instantaneous power failure	Pr. 261 to Pr. 266, Pr. 294
	Stop-on-contact control	Pr. 6, Pr. 270, Pr. 275, Pr. 276
	Brake sequence function	Pr. 278 to Pr. 285, Pr. 292
Function assignment of external terminal and control	Function assignment of input terminal	Pr. 178 to Pr. 189
	Start signal selection	Pr. 250
	Logic selection of output stop signal (MRS)	Pr. 17
	Selection of action conditions of the second (third) function signal (RT(X9))	Pr. 155
	Terminal assignment of output terminal	Pr. 190 to Pr. 196
	Output frequency detection (SU, FU, FU2, FU3, FB, FB2, FB3, LS signal)	Pr. 41 to Pr. 43, Pr. 50, Pr. 116, Pr. 865
	Output current detection (Y12 signal) Zero current detection (Y13 signal)	Pr. 150 to Pr. 153, Pr. 166, Pr. 167
	Remote output function (REM signal)	Pr. 495 to Pr. 497
Monitor display and monitor output signal	Initial settings of RS-485 communication	Pr. 37, Pr. 144
	Change of DU/PU monitor descriptions Cumulative monitor clear	Pr. 52, Pr. 170, Pr. 171, Pr. 563, Pr. 564, Pr. 891
	Change of the monitor output from terminal FM and AM	Pr. 54 to Pr. 56, Pr. 158, Pr. 866, Pr. 867
	Adjustment of terminal FM and AM (calibration)	C0 (Pr. 900), C1 (Pr. 901)
	Energy saving monitor	Pr. 891 to Pr. 899
Output frequency detection, current and torque	Output frequency detection (SU, FU, FU2, FU3, FB, FB2, FB3, LS signal)	Pr. 41 to Pr. 43, Pr. 50, Pr. 116, Pr. 865
	Output current detection (Y12 signal) Zero current detection (Y13 signal)	Pr. 150 to Pr. 153, Pr. 166, Pr. 167
	Torque detection (TU signal)	Pr. 864
Operation selection at power failure and instantaneous power failure	Restart operation after instantaneous power failure/Flying start	Pr. 57, Pr. 58, Pr. 162 to Pr. 165, Pr. 299, Pr. 611
	Decelerate the motor to a stop at instantaneous power failure	Pr. 261 to Pr. 266, Pr. 294
Operation setting at fault occurrence	Retry function at fault occurrence	Pr. 65, Pr. 67 to Pr. 69
	Output function of fault code	Pr. 76
	Input/output phase failure protection selection	Pr. 251, Pr. 872
	Fault definition	Pr. 875
	Regeneration avoidance function	Pr. 882 to Pr. 886, Pr. 665

Purpose of Use		Parameter Number
Energy saving operation	Energy saving control selection	Pr. 60
	How much energy can be saved (energy saving monitor)	Pr. 891 to Pr. 899
Reduction of the motor noise Measures against noise and leakage currents	Carrier frequency and SoftPWM selection	Pr. 72, Pr. 240
	Noise elimination at the analog input	Pr. 74, Pr. 822, Pr. 826, Pr. 832, Pr. 836, Pr. 849
Frequency setting by analog input	Analog input selection	Pr. 73, Pr. 267
	Override function	Pr. 73, Pr. 252, Pr. 253
	Noise elimination at the analog input	Pr. 74, Pr. 822, Pr. 826, Pr. 832, Pr. 836, Pr. 849
	Change of analog input frequency, adjustment of voltage, current input and frequency (calibration)	Pr. 125, Pr. 126, Pr. 241, C2 to C7 (Pr. 902 to Pr. 905)
	Compensation at the analog input	Pr. 242, Pr. 243
Misoperation prevention and parameter setting restriction	Reset selection, disconnected PU detection	Pr. 75
	Prevention of parameter rewrite Password function	Pr. 77, Pr. 296, Pr. 297
	Prevention of reverse rotation of the motor	Pr. 78
	Display necessary parameters only. (user group)	Pr. 160, Pr. 172 to Pr. 174
	Control of parameter write by communication	Pr. 342
Selection of operation mode and operation location	Operation mode selection	Pr. 79
	Operation mode when power is on	Pr. 79, Pr. 340
	Operation command source and speed command source during communication operation	Pr. 338, Pr. 339
	Selection of the NET mode operation control source	Pr. 550
	Selection of the PU mode operation control source	Pr. 551
Communication operation and setting	Initial settings of RS-485 communication	Pr. 117 to Pr. 124, Pr. 331 to Pr. 337, Pr. 341
	Control of parameter write by communication	Pr. 342
	Modbus-RTU communication specifications	Pr. 343, Pr. 539
	Operation command source and speed command source during communication operation	Pr. 338, Pr. 339
	Use setup software (USB communication)	Pr. 547, Pr. 548
	Selection of the NET mode operation control source	Pr. 550
	Modbus-RTU protocol (communication protocol selection)	Pr. 549
Special operation and frequency control	PID control	Pr. 127 to Pr. 134, Pr. 575 to Pr. 577
	Switch between the inverter operation and commercial power-supply operation to use	Pr. 135 to Pr. 139, Pr. 159
	Operate at a high speed when a load is light. (load torque high speed frequency control)	Pr. 4, Pr. 5, Pr. 270 to Pr. 274
	Droop control	Pr. 286 to Pr. 288
	Frequency control by pulse train input	Pr. 291, Pr. 384 to Pr. 386
Useful functions	Free parameter	Pr. 888, Pr. 889
	Increase cooling fan life	Pr. 244
	To determine the maintenance time of parts.	Pr. 255 to Pr. 259, Pr. 503, Pr. 504
	How much energy can be saved (energy saving monitor)	Pr. 60, Pr. 891 to Pr. 899
Setting from the parameter unit and operation panel	Parameter unit language switchover	Pr. 145
	Operation selection of the operation panel	Pr. 161
	Buzzer control of the operation panel	Pr. 990
	Contrast adjustment of the parameter unit	Pr. 991

4.6.2 Parameter list

· ◎ indicates simple mode parameters.
· The abbreviations in the explanations below indicate:

V/F ...V/F control

Magnetic flux ...Advanced magnetic flux vector control

Sensorless ...Real sensorless vector control

Vector ...vector control.

(Parameters without any indication are valid for all control)

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Manual torque boost V/F	0	◎	Torque boost	0.1%	3/2% *	0 to 30%	Set the output voltage at 0Hz as %. * The initial value differs according to the inverter capacity. (7.5K or lower / 11K or higher)
		46	Second torque boost	0.1%	9999	0 to 30%	Set the torque boost when the RT signal is on.
						9999	Without second torque boost
		112	Third torque boost	0.1%	9999	0 to 30%	Set the torque boost when the X9 signal is on.
						9999	Without third torque boost
Maximum/minimum frequency	1	◎	Maximum frequency	0.01Hz	120Hz	0 to 120Hz	Set the upper limit of the output frequency.
	2	◎	Minimum frequency	0.01Hz	0Hz	0 to 120Hz	Set the lower limit of the output frequency.
		18	High speed maximum frequency	0.01Hz	120Hz	120 to 400Hz	Set when performing the operation at 120Hz or more.
Base frequency, voltage V/F	3	◎	Base frequency	0.01Hz	60Hz	0 to 400Hz	Set the frequency when the motor rated torque is generated. (50Hz/60Hz)
		19	Base frequency voltage	0.1V	9999	0 to 1000V	Set the base voltage.
						8888	95% of power supply voltage
						9999	Same as power supply voltage
		47	Second V/F (base frequency)	0.01Hz	9999	0 to 400Hz	Set the base frequency when the RT signal is on.
						9999	Second V/F is invalid
		113	Third V/F (base frequency)	0.01Hz	9999	0 to 400Hz	Set the base frequency when the X9 signal is ON.
						9999	Third V/F is invalid
Multi-speed setting operation	4	◎	Multi-speed setting (high speed)	0.01Hz	60Hz	0 to 400Hz	Set frequency when the RH signal is on.
	5	◎	Multi-speed setting (middle speed)	0.01Hz	30Hz	0 to 400Hz	Set frequency when the RM signal is on.
	6	◎	Multi-speed setting (low speed)	0.01Hz	10Hz	0 to 400Hz	Set frequency when the RL signal is on.
		24 to 27	Multi-speed setting (4 speed to 7 speed)	0.01Hz	9999	0 to 400Hz, 9999	Frequency from 4 speed to 15 speed can be set according to the combination of the RH, RM, RL and REX signals. 9999: not selected
		232 to 239	Multi-speed setting (8 speed to 15 speed)	0.01Hz	9999	0 to 400Hz, 9999	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Acceleration/deceleration time setting	7	◎	Acceleration time	0.1/ 0.01s	5/15s *	0 to 3600/ 360s	Set the motor acceleration time. * The initial value differs according to the inverter capacity. (7.5K or lower/11K or higher)	
	8	◎	Deceleration time	0.1/ 0.01s	5/15s *	0 to 3600/ 360s	Set the motor deceleration time. * The initial value differs according to the inverter capacity. (7.5K or lower/11K or higher)	
		20	Acceleration/deceleration reference frequency	0.01Hz	60Hz	1 to 400Hz	Set the frequency referenced as acceleration/ deceleration time. Set the frequency change time from stop to *Pr. 20* for acceleration/deceleration time.	
		21	Acceleration/deceleration time increments	1	0	0	Increments: 0.1s Range: 0 to 3600s	The increments and setting range of acceleration/deceleration time setting can be changed.
						1	Increments: 0.01s Range: 0 to 360s	
		44	Second acceleration/ deceleration time	0.1/ 0.01s	5s	0 to 3600/ 360s	Set the acceleration/deceleration time when the RT signal is on.	
		45	Second deceleration time	0.1/ 0.01s	9999	0 to 3600/ 360s	Set the deceleration time when the RT signal is on.	
						9999	Acceleration time = deceleration time	
		110	Third acceleration/ deceleration time	0.1/ 0.01Hz	9999	0 to 3600/ 360s	Set the acceleration/deceleration time when the X9 signal is on.	
						9999	Function invalid	
		111	Third deceleration time	0.1/ 0.01Hz	9999	0 to 3600/ 360s	Set the deceleration time when the X9 signal is on.	
						9999	Acceleration time = deceleration time	
Motor protection from overheat (electronic thermal relay function)	9	◎	Electronic thermal O/L relay	0.01A	Rated inverter current	0 to 500A	Set the rated motor current.	
		51	Second electronic thermal O/L relay	0.01A	9999	0 to 500A	Valid when the RT signal is on. Set the rated motor current.	
						9999	Second electronic thermal O/L relay invalid	
DC injection brake	10		DC injection brake operation frequency	0.01Hz	3/0.5Hz*	0 to 120Hz	Operation frequency of the DC injection brake. * The initial value changes from 3Hz to 0.5Hz when a control mode other than vector is changed to vector control.	
						9999	Operate when the output frequency becomes less than or equal to *Pr. 13 Starting frequency*.	
	11		DC injection brake operation time	0.1s	0.5s	0	DC injection brake disabled	
						0.1 to 10s	Operation time of the DC injection brake	
						8888	Operated while the X13 signal is on.	
	12		DC injection brake operation voltage	0.1%	4/2% *	0	DC injection brake disabled	
						0.1 to 30%	DC injection brake voltage (torque) * The initial value differs according to the inverter capacity. (7.5K or lower/11K or higher)	
		802	Pre-excitation selection	1	0	0	Zero speed control	Setting can be made under vector control.
						1	Servo lock	
		850	Brake operation selection	1	0	0	DC injection brake	
						1	Zero speed control (under Real sensorless vector control)	
						2	Magnetic flux decay output shutoff (under Real sensorless vector control)	
Starting frequency	13		Starting frequency	0.01Hz	0.5Hz	0 to 60Hz	Starting frequency	
		571	Holding time at a start	0.1s	9999	0.0 to 10.0s	Holding time of *Pr. 13 Starting frequency*.	
						9999	Holding function at a start is invalid	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
V/F pattern matching applications V/F	14		Load pattern selection	1	0	0	For constant-torque load
						1	For variable-torque load
						2	For constant-torque lift: Boost for reverse rotation 0%
						3	For constant-torque lift: Boost for forward rotation 0%
						4	RT signal ON .... For constant-torque load (Same as in setting 0) RT signal OFF .. For constant-torque lift Boost for reverse rotation 0% (Same as in setting 2)
						5	RT signal ON .... For constant-torque load (Same as in setting 0) RT signal OFF .. For constant-torque lift Boost for forward rotation 0% (Same as in setting 3)
Jog operation	15		Jog frequency	0.01Hz	5Hz	0 to 400Hz	Set the frequency for jog operation.
	16		Jog acceleration/ deceleration time	0.1/ 0.01s	0.5s	0 to 3600/ 360s	Set the acceleration/deceleration time for jog operation. Set the time taken to reach the frequency set in *Pr. 20 Acceleration/deceleration reference frequency* for acceleration/deceleration time. (Initial value is 60Hz) In addition, acceleration/deceleration time can not be set separately.
Logic selection of output stop signal (MRS)	17		MRS input selection	1	0	0	Open input always
						2	Normally closed input (NC contact input specifications)
						4	External terminal: Normally closed input (NC contact input specifications) Communication : Normally open input
—	18		Refer to *Pr. 1 and Pr. 2*.				
	19		Refer to *Pr. 3*.				
	20, 21		Refer to *Pr. 7 and Pr. 8*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Stall prevention operation Magnetic flux V/F	22		Stall prevention operation level	0.1%	150%	0	Stall prevention operation selection becomes invalid.
						0.1 to 400%	Function as stall prevention operation under V/F control and Advanced magnetic flux vector control. Set the current value at which stall prevention operation is started. Refer to *page 107* for torque limit level.
	23		Stall prevention operation level compensation factor at double speed	0.1%	9999	0 to 200%	The stall operation level can be reduced when operating at a high speed above the rated frequency.
						9999	Constant according to *Pr. 22*
		48	Second stall prevention operation current	0.1%	150%	0	Second stall prevention operation invalid
						0.1 to 220%	The stall prevention operation level can be set.
		49	Second stall prevention operation frequency	0.01Hz	0Hz	0	Second stall prevention operation invalid
						0.01 to 400Hz	Set the frequency at which stall prevention operation of *Pr. 48* is started.
						9999	*Pr.48* is valid when the RT signal is on.
		66	Stall prevention operation reduction starting frequency	0.01Hz	60Hz	0 to 400Hz	Set the frequency at which the stall operation level is started to reduce.
		114	Third stall prevention operation current	0.1%	150%	0	Third stall prevention operation invalid
						0.1 to 220%	The stall prevention operation level can be set.
		115	Third stall prevention operation frequency	0.01Hz	0	0	Third stall prevention operation invalid
						0.01 to 400Hz	Set the frequency at which stall prevention operation of *Pr. 114* is started.
		148	Stall prevention level at 0V input	0.1%	150%	0 to 220%	When "4" is set in *Pr. 868* (*Pr. 858*), stall prevention operation level can be changed by the analog signal input to terminal 1 (terminal 4).
		149	Stall prevention level at 10V input	0.1%	200%	0 to 220%	
		154	Voltage reduction selection during stall prevention operation	1	1	0	With voltage reduction — You can select whether to use output voltage reduction during stall prevention operation or not.
						1	Without voltage reduction
		156	Stall prevention operation selection	1	0	0 to 31, 100, 101	*Pr. 156* allows you to select whether to use stall prevention or not according to the acceleration/deceleration status.
		157	OL signal output timer	0.1s	0s	0 to 25s	Set the output start time of the OL signal output when stall prevention is activated.
						9999	Without the OL signal output
		858	Terminal 4 function assignment	Refer to *page 137*.			
		868	Terminal 1 function assignment				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Torque limit level (Vector / Sensorless)	22		Torque limit level	0.1%	150%	0 to 400%	This functions as torque limit level under Real sensorless vector control. Refer to *page 106* for stall prevention operation level.
		157	OL signal output timer	0.1s	0s	0 to 25s	Set the output start time of the OL signal output when torque limit is activated.
						9999	Without the OL signal output
		803	Constant power range torque characteristic selection	1	0	0	Constant output limit (torque current limit and control)
						1	Constant-torque limit (torque limit and control)
		810	Torque limit input method selection	1	0	0	Internal torque limit Parameter-set torque limit operation is performed.
						1	External torque limit Torque limit based on the analog input from terminal 1 and 4.
		811	Set resolution switchover	1	0		**Running speed increments** / **Torque limit increments**
						0	1r/min / 0.1% increments
						1	0.1r/min
						10	1r/min / 0.01% increments
						11	0.1r/min
		812	Torque limit level (regeneration)	0.1%	9999	0 to 400%	Set the torque limit level for forward rotation regeneration.
						9999	*Pr. 22* value is used for limit.
		813	Torque limit level (3rd quadrant)	0.1%	9999	0 to 400%	Set the torque limit level for reverse rotation driving.
						9999	*Pr. 22* value is used for limit.
		814	Torque limit level (4th quadrant)	0.1%	9999	0 to 400%	Set the torque limit level for reverse rotation regeneration.
						9999	*Pr. 22* value is used for limit.
		815	Torque limit level 2	0.1%	9999	0 to 400%	When the torque limit selection (TL) signal is on, the *Pr. 815* value is a torque limit value regardless of *Pr. 810*.
						9999	The torque limit set to *Pr. 810* is active.
		816	Torque limit level during acceleration	0.1%	9999	0 to 400%	Set the torque limit value during acceleration.
						9999	Same torque limit as at constant speed
		817	Torque limit level during deceleration	0.1%	9999	0 to 400%	Set the torque limit value during deceleration.
						9999	Same torque limit as at constant speed
		874	OLT level setting	0.1%	150%	0 to 200%	This function can make an inverter trip if the torque limit is activated to stall the motor. Set the output torque at which an inverter trip is made in *Pr. 874* .
—	24 to 27		Refer to *Pr. 4 to Pr. 6*.				
Input compensation of multi-speed and remote setting	28		Multi-speed input compensation selection	1	0	0	Without compensation
						1	With compensation

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Acceleration/deceleration pattern and backlash measures	29		Acceleration/deceleration pattern selection	1	0	0	Linear acceleration/ deceleration
						1	S-pattern acceleration/deceleration A
						2	S-pattern acceleration/deceleration B
						3	Backlash measures
						4	S-pattern acceleration/deceleration C
						5	S-pattern acceleration/deceleration D
		140	Backlash acceleration stopping frequency	0.01Hz	1Hz	0 to 400Hz	Set the stopping frequency and time for backlash measures. Valid when *Pr. 29* = "3"
		141	Backlash acceleration stopping time	0.1s	0.5s	0 to 360s	
		142	Backlash deceleration stopping frequency	0.01Hz	1Hz	0 to 400Hz	
		143	Backlash deceleration stopping time	0.1s	0.5s	0 to 360s	
		380	Acceleration S-pattern 1	1%	0%	0 to 50%	Valid when S-pattern acceleration/deceleration C (*Pr. 29* = 4) is set. Set the time taken for S-pattern from starting of acceleration/deceleration to linear acceleration as % to the acceleration/deceleration time (*Pr. 7*, *Pr. 8*, etc.) An acceleration/deceleration pattern can be changed with the X20 signal.
		381	Deceleration S-pattern 1	1%	0%	0 to 50%	
		382	Acceleration S-pattern 2	1%	0%	0 to 50%	
		383	Deceleration S-pattern 2	1%	0%	0 to 50%	
		516	S-pattern time at a start of acceleration	0.1s	0.1s	0.1 to 2.5s	Valid when S-pattern acceleration/deceleration D (*Pr. 29* = 5) is set. Set the time taken for S-pattern acceleration/ deceleration (S-pattern operation).
		517	S-pattern time at a completion of acceleration	0.1s	0.1s	0.1 to 2.5s	
		518	S-pattern time at a start of deceleration	0.1s	0.1s	0.1 to 2.5s	
		519	S-pattern time at a completion of deceleration	0.1s	0.1s	0.1 to 2.5s	
Avoid mechanical resonance points (frequency jump)	31		Frequency jump 1A	0.01Hz	9999	0 to 400Hz, 9999	1A to 1B, 2A to 2B, 3A to 3B is frequency jumps 9999: Function invalid
	32		Frequency jump 1B	0.01Hz	9999	0 to 400Hz, 9999	
	33		Frequency jump 2A	0.01Hz	9999	0 to 400Hz, 9999	
	34		Frequency jump 2B	0.01Hz	9999	0 to 400Hz, 9999	
	35		Frequency jump 3A	0.01Hz	9999	0 to 400Hz, 9999	
	36		Frequency jump 3B	0.01Hz	9999	0 to 400Hz, 9999	
Speed display and speed setting	37		Speed display	1	0	0	Frequency display, setting
						1 to 9998	Set the machine speed for *Pr.505* Set frequency.
		144	Speed setting switchover	1	4	0, 2, 4, 6, 8, 10, 102, 104, 106, 108, 110	Set the number of motor poles when displaying the motor speed. A setting value is automatically changed depending on the *Pr.81* setting.
		505	Speed setting reference	0.01Hz	60Hz	1 to 120Hz	Set the frequency that will be the basis of machine speed display.
		811	Easy gain tuning response level setting	1	0		**Running speed increments** / **Torque limit increments**
						0	1r/min / 0.1% increments
						1	0.1r/min
						10	1r/min / 0.01% increments
						11	0.1r/min

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Output frequency detection and motor speed (SU, FU, FU2, FU3, FB, FB2, FB3, LS signal)	41		Up-to-frequency sensitivity	0.1%	10%	0 to 100%	Set the level where the SU signal turns on.
	42		Output frequency detection	0.01Hz	6Hz	0 to 400Hz	Set the frequency where the FU (FB) signal turns on.
	43		Output frequency detection for reverse rotation	0.01Hz	9999	0 to 400Hz	Set the frequency where the FU (FB) signal turns on in reverse rotation.
						9999	Same as *Pr. 42* setting
		50	Second output frequency detection	0.01Hz	30Hz	0 to 400Hz	Set the frequency where the FU2 (FB2) signal turns on.
		116	Third output frequency detection	0.01Hz	60Hz	0 to 400Hz	Set the frequency where the FU3 (FB3) signal turns on.
		865	Low speed detection	0.01Hz	1.5Hz	0 to 400Hz	Set the frequency where the LS signal turns on.
—	44, 45		Refer to *Pr. 7 and Pr. 8*.				
	46		Refer to *Pr. 0*.				
	47		Refer to *Pr. 3*.				
	48, 49		Refer to *Pr. 22 and Pr. 23*.				
	50		Refer to *Pr. 41 to Pr. 43*.				
	51		Refer to *Pr. 9*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Change of DU/PU monitor descriptions Cumulative monitor clear	52		DU/PU main display data selection	1	0	0, 5 to 8, 10 to 14, 17 to 20, 22 to 25, 32 to 35, 50 to 57, 65, 66, 100	Select monitor to be displayed on the operation panel and parameter unit and monitor to be output to the terminal FM and AM. 0 : Output frequency *(Pr. 52)* 1 : Output frequency *(Pr. 54, Pr. 158)* 2 : Output current *(Pr. 54, Pr. 158)* 3 : Output voltage *(Pr. 54, Pr. 158)* 5 : Frequency setting 6 : Running speed 7 : Motor torque 8 : Converter output voltage 10 : Electronic thermal relay function load factor 11 : Output current peak value 12 : Converter output voltage peak value 13 : Input power 14 : Output power 17 : Load meter 18 : Motor excitation current 19 : Position pulse *1 *(Pr. 52)* 20 : Cumulative energization time *(Pr. 52)* 21 : Reference voltage output *(Pr. 54, Pr. 158)* 22 : Orientation status *1 *(Pr. 52)* 23 : Actual operation time *(Pr. 52)* 24 : Motor load factor 25 : Cumulative power *(Pr. 52)* 32 : Torque command 33 : Torque current command 34 : Motor output 35 : Feedback pulse *1 *(Pr. 52)* 50 : Power saving effect 51 : Cumulative saving power *(Pr. 52)* 52 : PID set point 53 : PID measured value 54 : PID deviation (*Pr. 52*) 55 : Input/output terminal status *(Pr. 52)* 56 : Option input terminal status *(Pr. 52)* 57 : Option output terminal status *(Pr. 52)* 65 : Output power (with regenerative display) *(Pr. 52)* 66 : Cumulative regenerative power *(Pr. 52)* 100 : Set frequency is displayed during a stop and output frequency is displayed during operation *(Pr. 52)* *1 Available only when the FR-A7AP/FR-A7AL (option) is mounted.
	54		FM terminal function selection	1	1	1 to 3, 5 to 8, 10 to 14, 17, 18, 21, 24, 32 to 34, 50, 52, 53	
		158	AM terminal function selection	1	1	1 to 3, 5 to 8, 10 to 14, 17, 18, 21, 24, 32 to 34, 50, 52, 53	
		170	Watt-hour meter clear	1	9999	0	Set "0" to clear the watt-hour meter monitor.
						2	Set "2" to clear the cumulative regenerative power monitor.
						10	Sets the maximum value for the monitoring from communication to 9999kWh.
						9999	Sets the maximum value for the monitoring from communication to 65535kWh.
		171	Operation hour meter clear	1	9999	0, 9999	Set "0" to clear the operation time monitor. Setting "9999" has no effect.
		268	Monitor decimal digits selection	1	9999	0	Displays the monitor as integral value.
						1	Displays the monitor in increments of 0.1.
						9999	No fixed decimal position
		563	Energization time carrying-over times	1	0	(0 to 65535)	The numbers of cumulative energization time monitor exceeded 65535h is displayed. Reading only
		564	Operating time carrying-over times	1	0	(0 to 65535)	The numbers of operation time monitor exceeded 65535h is displayed. Reading only
		867	AM output filter	0.01s	0.01s	0 to 5s	Set the output filter of terminal AM.
		891	Cumulative power monitor digit shifted times	1	9999	0 to 4	Set the number of times to shift the cumulative power monitor digit. Clamps the monitor value at maximum.
						9999	No shift Clears the monitor value when it exceeds the maximum value.

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Change of the monitor output from terminal FM and AM	55		Frequency monitoring reference	0.01Hz	60Hz	0 to 400Hz	Set the full-scale value to output the output frequency monitor value to terminal FM and AM.
	56		Current monitoring reference	0.01A	Rated inverter current	0 to 500A	Set the full-scale value to output the output current monitor value to terminal FM and AM.
		866	Torque monitoring reference	0.1%	150%	0 to 400%	Set the full-scale value to output the torque monitor value to terminal FM and AM.
Restart operation after instantaneous power failure	57		Restart coasting time	0.1s	9999	0	The coasting time is as follows: 7.5K or lower..... 1.0s, 11K or higher 3.0s
						0.1 to 5s	Set the waiting time for inverter-triggered restart after an instantaneous power failure.
						9999	No restart
	58		Restart cushion time	0.1s	1s	0 to 60s	Set a voltage starting time at restart.
		162	Automatic restart after instantaneous power failure selection	1	0	0	With frequency search
						1	Without frequency search (Reduced voltage system)
						2	Encoder detection frequency
						10	Frequency search at every start
						11	Reduced voltage system at every start
						12	Encoder detection frequency at every start
		163	First cushion time for restart	0.1s	0s	0 to 20s	Set a voltage starting time at restart. Consider according to the magnitude of load (moment of inertia/torque).
		164	First cushion voltage for restart	0.1%	0%	0 to 100%	
		165	Stall prevention operation level for restart	0.1%	150%	0 to 220%	Consider the rated inverter current as 100% and set the stall prevention operation level during restart operation.
		299	Rotation direction detection selection at restarting	1	0	0	Without rotation direction detection
						1	With rotation direction detection
						9999	When *Pr. 78* = "0", the rotation direction is detected. When *Pr. 78* = "1", "2", the rotation direction is not detected.
		611	Acceleration time at a restart	0.1s	5s	0 to 3600s	Set the acceleration time to reach the *Pr. 20 Acceleration/deceleration reference frequency* at a restart.
						9999	Acceleration time for restart is the normal acceleration time (e.g. *Pr. 7*).
Remote setting function	59		Remote function selection	1	0	0	**RH, RM, RL signal function**: Multi-speed setting **Frequency setting storage function**: —
						1	Remote setting Yes
						2	Remote setting No
						3	Remote setting No (Turning STF/STR off clears remotely- set frequency.)
Energy saving control selection V/F	60		Energy saving control selection	1	0	0	Normal operation mode
						4	Energy saving operation mode

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Automatic acceleration/deceleration	61		Reference current	0.01A	9999	0 to 500A	Setting value (rated motor current) is referenced	
						9999	Rated inverter current is referenced	
	62		Reference value at acceleration	0.1%	9999	0 to 220%	Setting value is a limit value	Shortest acceleration/ deceleration mode
							Setting value is an optimum value	Optimum acceleration/ deceleration mode
						9999	150% is a limit value	Shortest acceleration/ deceleration mode
							100% is an optimum value	Optimum acceleration/ deceleration mode
	63		Reference value at deceleration	0.1%	9999	0 to 220%	Setting value is a limit value	Shortest acceleration/ deceleration mode
							Setting value is an optimum value	Optimum acceleration/ deceleration mode
						9999	150% is a limit value	Shortest acceleration/ deceleration mode
							100% is an optimum value	Optimum acceleration/ deceleration mode
	64		Starting frequency for elevator mode	0.01Hz	9999	0 to 10Hz	0 to 10Hz are starting frequency	
						9999	2Hz is starting frequency	
		292	Automatic acceleration/ deceleration	1	0	0	Normal mode	
						3	Optimum acceleration/deceleration mode	
						5	Elevator mode 1	
						6	Elevator mode 2	
						7	Brake sequence mode 1	
						8	Brake sequence mode 2	
						11	Shortest acceleration/deceleration mode	
		293	Acceleration/deceleration separate selection	1	0	0	Calculate acceleration/deceleration time of both acceleration and deceleration for the shortest and optimum acceleration/deceleration mode.	
						1	Calculate only acceleration time for the shortest and optimum acceleration/deceleration mode	
						2	Calculate only deceleration time for the shortest and optimum acceleration/deceleration mode	
Retry function at alarm occurrence	65		Retry selection	1	0	0 to 5	A fault for retry can be selected.	
		67	Number of retries at fault occurrence	1	0	0	No retry function	
						1 to 10	Set the number of retries at fault occurrence. A fault output is not provided during retry operation.	
						101 to 110	Set the number of retries at fault occurrence. (The setting value -100 is the number of retries.) A fault output is provided during retry operation.	
		68	Retry waiting time	0.1s	1s	0 to 10s	Set the waiting time from when an inverter fault occurs until a retry is made.	
		69	Retry count display erase	1	0	0	Clears the number of restarts succeeded by retry.	
—	66		Refer to *Pr. 22 and Pr. 23*.					
	67 to 69		Refer to *Pr. 65*.					

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Motor selection (applied motor)	71		Applied motor	1	0	0	Thermal characteristics of a standard motor	
						1	Thermal characteristics of the Mitsubishi constant-torque motor	
						2	Thermal characteristic of standard motor Adjustable 5 points V/F	
						30	Thermal characteristics of the Mitsubishi vector motor SF-V5RU (1500r/min series)	
						40	Thermal characteristic of Mitsubishi high efficiency motor (SF-HR)	
						50	Thermal characteristic of Mitsubishi constant-torque motor (SF-HRCA)	
						3	Standard motor	Select "offline auto tuning setting"
						13	Constant-torque motor Mitsubishi vector motor SF-V5RU (except for 1500 r/min series)	
						33	Mitsubishi vector motor SF-V5RU (1500r/min series), SF-THY	
						43	Mitsubishi high efficiency motor (SF-HR)	
						53	Mitsubishi constant-torque motor (SF-HRCA)	
						4	Standard motor	Auto tuning data can be read, changed, and set.
						14	Constant-torque motor Mitsubishi vector motor SF-V5RU (except for 1500 r/min series)	
						34	Mitsubishi vector motor SF-V5RU (1500r/min series), SF-THY	
						44	Mitsubishi high efficiency motor (SF-HR)	
						54	Mitsubishi constant-torque motor (SF-HRCA)	
						5	Standard motor	Star connection Direct input of motor constants is enabled
						15	Constant-torque motor	
						6	Standard motor	Delta connection Direct input of motor constants is enabled
						16	Constant-torque motor	
						7	Standard motor	Star connection Motor constants direct input + Offline auto tuning
						17	Constant-torque motor	
						8	Standard motor	Delta connection Motor constants direct input + Offline auto tuning
						18	Constant-torque motor	
		450	Second applied motor	1	9999	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54	Set when using the second motor. (same specifications as *Pr. 71*)	
						9999	Second motor is invalid	
Carrier frequency and SoftPWM selection	72		PWM frequency selection	1	2	0 to 15	PWM carrier frequency can be changed. The setting displayed is in [kHz]. Note that 0 indicates 0.7kHz, 15 indicates 14.5kHz. The following settings are for Real sensorless vector control and vector control. 0 to 5: 2kHz, 6 to 9: 6kHz, 10 to 13: 10kHz, 14 to 15: 14kHz	
		240	Soft-PWM operation selection	1	1	0	Soft-PWM invalid	
						1	When *Pr. 72* = "0 to 5", Soft-PWM is valid.	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Analog input selection	73		Analog input selection	1	1	0 to 7, 10 to 17	You can select the input specifications of terminal 2 (0 to 5V, 0 to 10V, 0 to 20mA) and input specifications of terminal 1 (0 to ±5V, 0 to ±10V). To change the terminal 2 to the voltage input specification (0 to 5V/ 0 to 10V), turn OFF (initial status) the voltage/current input switch 2. To change it to the current input (0 to 20mA), turn ON the voltage/current input switch 2. Override and reversible operation can be selected.
		242	Terminal 1 added compensation amount (terminal 2)	0.1%	100%	0 to 100%	Set the ratio of added compensation amount when terminal 2 is the main speed.
		243	Terminal 1 added compensation amount (terminal 4)	0.1%	75%	0 to 100%	Set the ratio of added compensation amount when terminal 4 is the main speed.
		252	Override bias	0.1%	50%	0 to 200%	Set the bias side compensation value of override function.
		253	Override gain	0.1%	150%	0 to 200%	Set the gain side compensation value of override function.
		267	Terminal 4 input selection	1	0	0	Terminal 4 input 4 to 20mA — Turn ON the voltage/ current input switch 1(initial status).
						1	Terminal 4 input 0 to 5V — Turn OFF the voltage/ current input switch 1.
						2	Terminal 4 input 0 to 10V — Turn OFF the voltage/ current input switch 1.
Response level of analog input and noise elimination	74		Input filter time constant	1	1	0 to 8	The primary delay filter time constant for the analog input can be set. A larger setting results slower response.
		822	Speed setting filter 1	0.001s	9999	0 to 5s, 9999	Set the time constant of the primary delay filter relative to the external speed command (analog input command).
		826	Torque setting filter 1	0.001s	9999	0 to 5s, 9999	Set the time constant of the primary delay filter relative to the external torque command (analog input command).
		832	Speed setting filter 2	0.001s	9999	0 to 5s, 9999	Second function of *Pr. 822* (valid when the RT terminal is on)
		836	Torque setting filter 2	0.001s	9999	0 to 5s, 9999	Second function of *Pr. 826* (valid when the RT terminal is on)
		849	Analog input offset adjustment	0.1%	100%	0 to 200%	This function provides speed command by analog input (terminal 2) with offset and avoids frequency command to be given due to noise under 0 speed command.
Reset selection, disconnected PU detection	75		Reset selection/ disconnected PU detection/ PU stop selection	1	14	0 to 3, 14 to 17	You can select the reset input acceptance, disconnected PU (FR-DU07/FR-PU07/FR-PU04) connector detection function and PU stop function. For the initial value, reset always enabled, without disconnected PU detection, and with PU stop function are set.
Output function of alarm code	76		Fault code output selection	1	0	0	Without fault code output
						1	With fault code output
						2	Fault code output at fault occurrence only
Prevention of parameter rewrite	77		Parameter write selection	1	0	0	Write is enabled only during a stop
						1	Parameter write is disabled.
						2	Parameter write is enabled in any operation mode regardless of operating status.
Prevention of reverse rotation of the motor	78		Reverse rotation prevention selection	1	0	0	Both forward and reverse rotations allowed
						1	Reverse rotation disallowed
						2	Forward rotation disallowed

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Operation mode selection	79	◎	Operation mode selection	1	0	0	External/PU switchover mode	
						1	Fixed to PU operation mode	
						2	Fixed to External operation mode	
						3	External/PU combined operation mode 1	
						4	External/PU combined operation mode 2	
						6	Switchover mode	
						7	External operation mode (PU operation interlock)	
		340	Communication startup mode selection	1	0	0	As set in *Pr. 79*.	
						1, 2	Started in the network operation mode. When the setting is "2", it will resume the pre-instantaneous power failure operation mode after an instantaneous power failure occurs.	
						10, 12	Started in the network operation mode. Operation mode can be changed between PU operation mode and network operation mode from the operation panel. When the setting is "12", it will resume the pre-instantaneous power failure operation mode after an instantaneous power failure occurs.	
Selection of control method (Vector / Sensorless / Magnetic flux)	80		Motor capacity	0.01kW	9999	0.4 to 55kW	Set the applied motor capacity.	
						9999	V/F control is performed	
	81		Number of motor poles	1	9999	2, 4, 6, 8, 10	Set the number of motor poles.	
						12, 14, 16, 18, 20	X18 signal-ON:V/F control	Set 10 + number of motor poles.
						9999	V/F control is performed	
		89	Speed control gain (magnetic flux vector)	0.1%	9999	0 to 200%	Motor speed fluctuation due to load fluctuation is adjusted during Advanced magnetic flux vector control. 100% is a referenced value.	
						9999	Gain matching with the motor set in *Pr.71*.	
		451	Second motor control method selection	1	9999	10, 11, 12	Select the method of controlling the second motor. (same as *Pr.800*)	
						20, 9999	V/F Control (Advanced magnetic flux vector control)	
		453	Second motor capacity	0.01kW	9999	0.4 to 55kW	Set the capacity of the second motor.	
						9999	V/F control is performed	
		454	Number of second motor poles	1	9999	2, 4, 6, 8, 10	Set the number of poles of the second motor.	
						9999	V/F control is performed	
		569	Second motor speed control gain	0.1%	9999	0 to 200%	Second motor speed fluctuation due to load fluctuation is adjusted during Advanced magnetic flux vector control. 100% is a referenced value.	
						9999	Gain matching with the motor set in *Pr.450*.	
		800	Control method selection	1	20	0	Speed control	Vector control (FR-A7AP/FR-A7AL)
						1	Torque control	
						2	MC signal-ON:torque MC signal-OFF:speed	
						3	Position control	
						4	MC signal-ON:position MC signal-OFF:speed	
						5	MC signal-ON:torque MC signal-OFF:position	
						9	Vector control test operation Test operation of vector control (speed control) can be performed without connecting a motor.	
						10	Speed control	Real sensorless vector control
						11	Torque control	
						12	MC signal-ON : Torque MC signal-OFF : Speed	
						20	V/F Control (Advanced magnetic flux vector control)	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Offline auto tuning Vector Sensorless Magnetic flux	82		Motor excitation current	0.01A	9999	0 to 500A	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
	83		Rated motor voltage	0.1V	200/ 400V *	0 to 1000V	Set the rated motor voltage(V). * The initial values differ according to the voltage level. (200V/400V)
	84		Rated motor frequency	0.01Hz	60Hz	10 to 120Hz	Set the rated motor frequency (Hz).
		90	Motor constant (R1)	0.001Ω	9999	0 to 50Ω	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		91	Motor constant (R2)	0.001Ω	9999	0 to 50Ω	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		92	Motor constant (L1)	0.001Ω (0.1mH)	9999	0 to 50Ω (0 to 1000mH)	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		93	Motor constant (L2)	0.001Ω (0.1mH)	9999	0 to 50Ω (0 to 1000mH)	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		94	Motor constant (X)	0.01Ω (0.1%)	9999	0 to 500Ω (0 to 100%)	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		96	Auto tuning setting/status	1	0	0	Auto tuning is not performed
						1	Tuning performed without motor running
						101	Tuning performed with motor running
		455	Second motor excitation current	0.01A	9999	0 to 500A	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		456	Rated second motor voltage	0.1V	200/ 400V *	0 to 1000V	Set the rated voltage (V) of the second motor. * The initial values differ according to the voltage level. (200V/400V)
		457	Rated second motor frequency	0.01Hz	60Hz	10 to 120Hz	Set the rated frequency (Hz) of the second motor.

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Offline auto tuning Vector Sensorless Magnetic flux		458	Second motor constant (R1)	0.001Ω	9999	0 to 50Ω	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		459	Second motor constant (R2)	0.001Ω	9999	0 to 50Ω	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		460	Second motor constant (L1)	0.001Ω (0.1mH)	9999	0 to 50Ω (0 to 1000mH)	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		461	Second motor constant (L2)	0.001Ω (0.1mH)	9999	0 to 50Ω (0 to 1000mH)	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		462	Second motor constant (X)	0.01Ω (0.1%)	9999	0 to 500Ω (0 to 100%)	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		463	Second motor auto tuning setting/status	1	0	0, 1, 101	Set the tuning mode of the second motor. (same as *Pr. 96*)
		684	Tuning data unit switchover	1	0	0	Internal data converter value
						1	Displayed in "A, Ω, mH, %".
		859	Torque current	0.01A	9999	0 to 500A	Tuning data (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
		860	Second motor torque current	0.01A	9999	0 to 500A	Tuning data of the second motor (The value measured by offline auto tuning is automatically set.)
						9999	Use the Mitsubishi motor (SF-JR, SF-HR, SF-JRCA, SF-HRCA, SF-V5RU (1500r/min series)) constants
—	89		Refer to *Pr. 81*.				
	90 to 94		Refer to *Pr. 82* to *Pr. 84*.				
Online auto tuning Vector Sensorless Magnetic flux	95		Online auto tuning selection	1	0	0	Online auto tuning is not performed
						1	Start-time tuning (at start-up)
						2	Magnetic flux observer (normal)
		574	Second motor online auto tuning	1	0	0, 1	Select the second motor online auto tuning. (same as *Pr. 95*)
—	96		Refer to *Pr. 82* to *Pr. 84*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Adjustable 5 points V/F (V/F)	100		V/F1(first frequency)	0.01Hz	9999	0 to 400Hz, 9999	Set each points (frequency, voltage) of V/F pattern. 9999: No V/F setting
	101		V/F1(first frequency voltage)	0.1V	0V	0 to 1000V	
	102		V/F2(second frequency)	0.01Hz	9999	0 to 400Hz, 9999	
	103		V/F2(second frequency voltage)	0.1V	0V	0 to 1000V	
	104		V/F3(third frequency)	0.01Hz	9999	0 to 400Hz, 9999	
	105		V/F3(third frequency voltage)	0.1V	0V	0 to 1000V	
	106		V/F4(fourth frequency)	0.01Hz	9999	0 to 400Hz, 9999	
	107		V/F4(fourth frequency voltage)	0.1V	0V	0 to 1000V	
	108		V/F5(fifth frequency)	0.01Hz	9999	0 to 400Hz, 9999	
	109		V/F5(fifth frequency voltage)	0.1V	0V	0 to 1000V	
		71	Refer to *page 113*.				
—	110, 111		Refer to *Pr. 7*.				
	112		Refer to *Pr. 0*.				
	113		Refer to *Pr. 3*.				
	114, 115		Refer to *Pr. 22*.				
	116		Refer to *Pr. 41*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
PU connector communication	117		PU communication station number	1	0	0 to 31	Specify the inverter station number. Set the inverter station numbers when two or more inverters are connected to one personal computer.
	118		PU communication speed	1	192	48, 96, 192, 384	Set the communication speed. The setting value × 100 equals the communication speed. For example, the communication speed is 19200bps when the setting value is "192".
	119		PU communication stop bit length	1	1	0	Stop bit length: 1bit data length: 8bit
						1	Stop bit length: 2bit data length: 8bit
						10	Stop bit length: 1bit data length: 7bit
						11	Stop bit length: 2bit data length: 7bit
	120		PU communication parity check	1	2	0	Without parity check
						1	With odd parity check
						2	With even parity check
	121		Number of PU communication retries	1	1	0 to 10	Set the permissible number of retries at occurrence of a data receive error. If the number of consecutive errors exceeds the permissible value, the inverter trips.
						9999	If a communication error occurs, the inverter will not come to trip.
	122		PU communication check time interval	0.1s	9999	0	No PU connector communication
						0.1 to 999.8s	Set the communication check time interval. If a no-communication state persists for longer than the permissible time, the inverter trips.
						9999	No communication check (signal loss detection)
	123		PU communication waiting time setting	1	9999	0 to 150ms	Set the waiting time between data transmission to the inverter and response.
						9999	Set with communication data.
	124		PU communication CR/LF selection	1	1	0	Without CR/LF
						1	With CR
						2	With CR/LF
		342	Communication EEPROM write selection	1	0	0	Parameter values written by communication are written to the EEPROM and RAM.
						1	Parameter values written by communication are written to the RAM.
		551	PU mode operation command source selection	1	2	1	Select the RS-485 terminals as PU operation mode control source.
						2	Select the PU connector as PU operation mode control source.
						3	Select the USB connector as PU operation mode control source.
Change of analog input frequency, adjustment of voltage, current input and frequency (calibration)	125 ◎		Terminal 2 frequency setting gain frequency	0.01Hz	60Hz	0 to 400Hz	Set the frequency of terminal 2 input gain (maximum).
	126 ◎		Terminal 4 frequency setting gain frequency	0.01Hz	60Hz	0 to 400Hz	Set the frequency of terminal 4 input gain (maximum). (Valid when *Pr. 858* = 0 (initial value))
		241	Analog input display unit switchover	1	0	0	Displayed in % — Select the unit for analog input display.
						1	Displayed in V/mA — Select the unit for analog input display.
		C2 (902)	Terminal 2 frequency setting bias frequency	0.01Hz	0Hz	0 to 400Hz	Set the frequency on the bias side of terminal 2 input.
		C3 (902)	Terminal 2 frequency setting bias	0.1%	0%	0 to 300%	Set the converted % of the bias side voltage (current) of terminal 2 input.
		C4 (903)	Terminal 2 frequency setting gain	0.1%	100%	0 to 300%	Set the converted % of the gain side voltage of terminal 2 input.
		C5 (904)	Terminal 4 frequency setting bias frequency	0.01Hz	0Hz	0 to 400Hz	Set the frequency on the bias side of terminal 4 input. (Valid when *Pr. 858* = 0 (initial value))
		C6 (904)	Terminal 4 frequency setting bias	0.1%	20%	0 to 300%	Set the converted % of the bias side current (voltage) of terminal 4 input. (Valid when *Pr. 858* = 0 (initial value))
		C7 (905)	Terminal 4 frequency setting gain	0.1%	100%	0 to 300%	Set the converted % of the gain side current (voltage) of terminal 4 input. (Valid when *Pr. 858* = 0 (initial value))

The parameter number in parentheses is the one for use with the parameter unit (FR-PU04/FR-PU07).

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
PID control	127		PID control automatic switchover frequency	0.01Hz	9999	0 to 400Hz	Set the frequency at which the control is automatically changed to PID control.	
						9999	Without PID automatic switchover function	
	128		PID action selection	1	10	10	PID reverse action	Deviation value signal (terminal 1)
						11	PID forward action	
						20	PID reverse action	Measured value input (terminal 4) Set value (terminal 2 or *Pr. 133*)
						21	PID forward action	
						50	PID reverse action	Deviation value signal input (LONWORKS, CC-Link communication)
						51	PID forward action	
						60	PID reverse action	Measured value, set value input (LONWORKS, CC-Link communication)
						61	PID forward action	
	129		PID proportional band	0.1%	100%	0.1 to 1000%	If the proportional band is narrow (parameter setting is small), the manipulated variable varies greatly with a slight change of the measured value. Hence, as the proportional band narrows, the response sensitivity (gain) improves but the stability deteriorates, e.g. hunting occurs. Gain K = 1/proportional band	
						9999	No proportional control	
	130		PID integral time	0.1s	1s	0.1 to 3600s	When deviation step is input, time (Ti) is the time required for only the integral (I) action to provide the same manipulated variable as that for the proportional (P) action. As the integral time decreases, the set point is reached earlier but hunting occurs more easily.	
						9999	No integral control.	
	131		PID upper limit	0.1%	9999	0 to 100%	Set the upper limit value. If the feedback value exceeds the setting, the FUP signal is output. The maximum input (20mA/5V/10V) of the measured value (terminal 4) is equivalent to 100%.	
						9999	No function	
	132		PID lower limit	0.1%	9999	0 to 100%	Set the lower limit value. If the measured value falls below the setting range, the FDN signal is output. The maximum input (20mA/5V/10V) of the measured value (terminal 4) is equivalent to 100%.	
						9999	No function	
	133		PID action set point	0.01%	9999	0 to 100%	Used to set the set point for PID control.	
						9999	Terminal 2 input voltage is the set point.	
	134		PID differential time	0.01s	9999	0.01 to 10.00s	For deviation lamp input, time (Td) required for providing only the manipulated variable for the proportional (P) action. As the differential time increases, greater response is made to a deviation change.	
						9999	No differential control.	
		575	Output interruption detection time	0.1s	1s	0 to 3600s	If the output frequency after PID operation remains lower than the *Pr. 576* setting for longer than the time set in *Pr. 575*, the inverter stops operation.	
						9999	Without output interruption function	
		576	Output interruption detection level	0.01Hz	0Hz	0 to 400Hz	Set the frequency at which the output interruption processing is performed.	
		577	Output interruption cancel level	0.1%	1000%	900 to 1100%	Set the level (*Pr. 577* -1000%) to release the PID output interruption function.	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Switch between the inverter operation and electronic bypass operation to use	135		Electronic bypass sequence selection	1	0	0	Without electronic bypass sequence
						1	With electronic bypass sequence
	136		MC switchover interlock time	0.1s	1s	0 to 100s	Set the operation interlock time of MC2 and MC3.
	137		Start waiting time	0.1s	0.5s	0 to 100s	Set the time slightly longer (0.3 to 0.5s or so) than the time from when the ON signal enters MC3 until it actually turns on.
	138		Bypass selection at a fault	1	0	0	Inverter output is stopped (motor coast) at inverter fault.
						1	Operation is automatically switched to bypass operation at inverter fault (Not switched when an external thermal relay operation (E.OHT) or CPU fault (E.CPU) occurs)
	139		Automatic switchover frequency from inverter to bypass operation	0.01Hz	9999	0 to 60Hz	Set the frequency to switch inverter operation to bypass operation.
						9999	Without automatic switchover
		159	Automatic switchover frequency range from bypass to inverter operation	0.01Hz	9999	0 to 10Hz	Valid during automatic switchover operation (*Pr. 139* ≠ 9999) When the frequency command decreases below (*Pr. 139 - Pr. 159*) after operation is switched from inverter operation to bypass operation, the inverter automatically switches operation to inverter operation and operates at the frequency of frequency command. When the inverter start command (STF/STR) is turned OFF, operation is switched to inverter operation also.
						9999	Valid during automatic switchover operation (*Pr. 139* ≠ 9999) When the inverter start command (STF/STR) is turned OFF after operation is switched from inverter operation to bypass operation, operation is switched to inverter operation and the motor decelerates to stop.
—	140 to 143		Refer to *Pr. 29*.				
	144		Refer to *Pr. 37*.				
Parameter unit language switchover	145		PU display language selection	1	0	0	Japanese
						1	English
						2	Germany
						3	French
						4	Spanish
						5	Italian
						6	Swedish
						7	Finnish
—	148,149		Refer to *Pr. 22*.				
Output current detection (Y12 signal) Zero current detection (Y13 signal)	150		Output current detection level	0.1%	150%	0 to 220%	Set the output current detection level. 100% is the rated inverter current.
	151		Output current detection signal delay time	0.1s	0s	0 to 10s	Set the output current detection period. Set the time from when the output current has risen above the setting until the output current detection signal (Y12) is output.
	152		Zero current detection level	0.1%	5%	0 to 220%	Set the zero current detection level. Suppose that the rated inverter current is 100%.
	153		Zero current detection time	0.01s	0.5s	0 to 1s	Set this parameter to define the period from when the output current drops below the *Pr. 152* value until the zero current detection signal (Y13) is output.
		166	Output current detection signal retention time	0.1s	0.1s	0 to 10s	Set the retention time when the Y12 signal is on.
						9999	The Y12 signal on status is retained. The signal is turned OFF at the next start.
		167	Output current detection operation selection	1	0	0	Operation continues when the Y12 signal is on
						1	The inverter trips when the Y12 signal is on. (E.CDO)
—	154		Refer to *Pr. 22*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Condition selection of function validity by the second function selection signal (RT) and third function(X9)	155		RT signal function validity condition selection	1	0	0	Second (third) function is immediately valid with on of the RT (X9) signal.	
						10	Second (third) function is valid only during the RT (X9) signal is on and constant speed operation. (invalid during acceleration/deceleration)	
—	156, 157		Refer to *Pr. 22* .					
	158		Refer to *Pr. 54* .					
	159		Refer to *Pr. 135* .					
User group function	160 ◎		User group read selection	1	0	0	All parameters can be displayed.	
						1	Only the parameters registered in the user group can be displayed.	
						9999	Only the simple mode parameters can be displayed.	
		172	User group registered display/batch clear	1	0	(0 to 16)	Displays the number of cases registered as a user group (reading only).	
						9999	Batch clear the user group registration	
		173	User group registration	1	9999	0 to 999, 9999	Set the parameter numbers to be registered to the user group. Read value is always "9999".	
		174	User group clear	1	9999	0 to 999, 9999	Set the parameter numbers to be cleared from the user group. Read value is always "9999".	
Operation selection of the operation panel	161		Frequency setting/key lock operation selection	1	0	0	Setting dial frequency setting mode	Key lock invalid
						1	Setting dial potentiometer mode	
						10	Setting dial frequency setting mode	Key lock valid
						11	Setting dial potentiometer mode	
—	162 to 165		Refer to *Pr. 57*.					
	166, 167		Refer to *Pr. 150*.					
	168, 169		Parameter for manufacturer setting. Do not set.					
	170, 171		Refer to *Pr. 52*.					
	172 to 174		Refer to *Pr. 160*.					

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Function assignment of input terminal	178		STF terminal function selection	1	60	0 to 9, 12 to 20, 22 to 28, 42 to 44, 60, 62, 64 to 69, 74, 9999	0: Low-speed operation command (RL) 1: Middle-speed operation command (RM) 2: High-speed operation command (RH) 3: Second function selection (RT) 4: Terminal 4 input selection (AU) 5: Jog operation selection (JOG) 6: Selection of automatic restart after instantaneous power failure, flying start (CS) 7: External thermal relay input (OH) 8: 15-speed selection (REX) 9: Third function (X9) 12: PU operation external interlock (X12) 13: External DC injection brake start (X13) 14: PID control valid terminal (X14) 15: Brake opening completion signal (BRI) 16: PU/External operation switchover (X16) 17: Load pattern selection forward/reverse rotation boost (X17) 18: V/F switchover (X18) 19: Load torque high-speed frequency (X19) 20: S-pattern acceleration/deceleration C switching terminal (X20) 22: Orientation command (X22) 23: Pre-excitation (LX) 24: Output stop (MRS) 25: Start self-holding selection (STOP) 26: Control mode changing (MC) 27: Torque limit selection (TL) 28: Start time tuning (X28) 42: Torque bias selection 1 (X42) * 43: Torque bias selection 2 (X43) * 44: P/PI control switchover (X44) 60: Forward rotation command (STF) (assigned to STF terminal (*Pr. 178*) only) 61: Reverse rotation command (STR) (assigned to STR terminal (*Pr. 179*) only) 62: Inverter reset (RES) 63: PTC thermistor input (PTC) (assigned to AU terminal (*Pr. 184*) only) 64: PID forward/reverse action switchover (X64) 65: PU/NET operation switchover (X65) 66: External/NET operation switchover (X66) 67: Command source switchover (X67) 68: Simple position pulse train sign (NP) * 69: Simple position droop pulse clear (CLR) * 74: Magnetic flux decay output shutoff (X74) 9999:No function * Available only when used with the FR-A7AP/FR-A7AL (option).
	179		STR terminal function selection	1	61	0 to 9, 12 to 20, 22 to 28, 42 to 44, 61, 62, 64 to 69, 74, 9999	
	180		RL terminal function selection	1	0	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62, 64 to 69, 74, 9999	
	181		RM terminal function selection	1	1		
	182		RH terminal function selection	1	2		
	183		RT terminal function selection	1	3		
	184		AU terminal function selection	1	4	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62 to 69, 74, 9999	
	185		JOG terminal function selection	1	5	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62, 64 to 69, 74, 9999	
	186		CS terminal function selection	1	6		
	187		MRS terminal function selection	1	24		
	188		STOP terminal function selection	1	25		
	189		RES terminal function selection	1	62		

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Terminal assignment of output terminal	190		RUN terminal function selection	1	0	0 to 6, 8, 10 to 20, 25 to 28, 30 to 36, 39, 41 to 47, 64, 70, 84, 90 to 99, 100 to 106, 108, 110 to 116, 120, 125 to 128, 130 to 136, 139, 141 to 147, 164, 170, 184, 190 to 199, 9999	0, 100: Inverter running (RUN) 1, 101: Up to frequency (SU) 2, 102: Instantaneous power failure/undervoltage (IPF) 3, 103: Overload warning (OL) 4, 104: Output frequency detection (FU) 5, 105: Second output frequency detection (FU2) 6, 106: Third output frequency detection (FU3) 8, 108: Electronic thermal O/L relay pre-alarm (THP) 10, 110:PU operation mode (PU) 11, 111: Inverter operation ready (RY) 12, 112:Output current detection (Y12) 13, 113:Zero current detection (Y13) 14, 114:PID lower limit (FDN) 15, 115:PID upper limit (FUP) 16, 116:PID forward/reverse rotation output (RL) 17, —: Electronic bypass MC1 (MC1) 18, —: Electronic bypass MC2 (MC2) 19, —: Electronic bypass MC3 (MC3) 20, 120:Brake opening request (BOF) 25, 125:Fan fault output (FAN) 26, 126:Heatsink overheat pre-alarm (FIN) 27, 127:Orientation complete (ORA) * 28, 128:Orientation fault (ORM) * 30, 130:Forward rotation output (Y30) * 31, 131:Reverse rotation output (Y31) * 32, 132:Regenerative status output (Y32) * 33, 133:Operation ready 2 (RY2) 34, 134:Low speed output (LS) 35, 135:Torque detection (TU) 36, 136:In-position (Y36) * 39, 139:Start time tuning completion (Y39) 41, 141:Speed detection (FB) 42, 142:Second speed detection (FB2) 43, 143:Third speed detection (FB3) 44, 144:Inverter running 2 (RUN2) 45, 145:Inverter running and start command is ON (RUN3) 46, 146:During deceleration at occurrence of power failure (retained until release) (Y46) 47, 147:During PID control activated (PID) 64, 164:During retry (Y64) 70, 170:PID output interruption (SLEEP) 84, 184:Position control preparation ready (RDY) * 90, 190:Life alarm (Y90) 91, 191:Fault output 3 (power-off signal) (Y91) 92, 192:Energy saving average value updated timing (Y92) 93, 193:Current average monitor signal (Y93) 94, 194:Fault output 2 (ALM2) 95, 195:Maintenance timer signal (Y95) 96, 196:Remote output (REM) 97, 197:Alarm output 2 (ER) 98, 198:Alarm output (LF) 99, 199:Fault output (ALM) 9999: No function 0 to 99: Positive logic 100 to 199: Negative logic * Available only when used with the FR-A7AP/FR-A7AL (option).
	191		SU terminal function selection	1	1		
	192		IPF terminal function selection	1	2		
	193		OL terminal function selection	1	3		
	194		FU terminal function selection	1	4		
	195		ABC1 terminal function selection	1	99	0 to 6, 8, 10 to 20, 25 to 28, 30 to 36, 39, 41 to 47, 64, 70, 84, 90, 91, 94 to 99, 100 to 106, 108, 110 to 116, 120, 125 to 128, 130 to 136, 139, 141 to 147, 164, 170, 184, 190, 191, 194 to 199, 9999	
	196		ABC2 terminal function selection	1	9999		
—	232 to 239		Refer to *Pr. 4 to Pr. 6*.				
	240		Refer to *Pr. 72*.				
	241		Refer to *Pr. 125 and Pr. 126*.				
	242, 243		Refer to *Pr. 73*.				

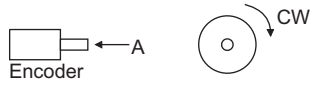
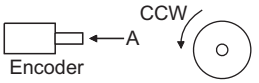
Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Increase cooling fan life	244		Cooling fan operation selection	1	1	0	Operates at power on Cooling fan on/off control invalid (The cooling fan is always on at power on)	
						1	Cooling fan on/off control valid The fan is normally on during inverter operation. The fan switches on/off according to the temperature during a stop of the inverter whose status is monitored.	
Slip compensation V/F	245		Rated slip	0.01%	9999	0 to 50%	Used to set the rated motor slip.	
						9999	No slip compensation	
	246		Slip compensation time constant	0.01s	0.5s	0.01 to 10s	Used to set the response time of slip compensation. When the value is made smaller, response will be faster. However, as load inertia is greater, a regenerative overvoltage (E.OV☐) error is more liable to occur.	
	247		Constant-power range slip compensation selection	1	9999	0	Slip compensation is not made in the constant power range (frequency range above the frequency set in *Pr. 3*)	
						9999	Slip compensation is made in the constant power range.	
Selection of motor stopping method	250		Stop selection	0.1s	9999	0 to 100s	The motor is coasted to a stop when the preset time elapses after the start signal is turned OFF.	STF signal: Forward rotation start STR signal: Reverse rotation start
						1000 to 1100s	The motor is coasted to a stop (*Pr. 250* - 1000)s after the start signal is turned OFF.	STF signal: Start signal STR signal: Forward/ reverse signal
						9999	When the start signal is turned OFF, the motor decelerates to stop.	STF signal: Forward rotation start STR signal: Reverse rotation start
						8888		STF signal: Start signal STR signal: Forward/ reverse signal
Input/output phase failure protection selection	251		Output phase loss protection selection	1	1	0	Without output phase failure protection	
						1	With output phase failure protection	
		872	Input phase loss protection selection	1	1	0	Without input phase failure protection	
						1	With input phase failure protection	
—	252, 253		Refer to *Pr. 73*.					
Display of the life of the inverter parts	255		Life alarm status display	1	0	(0 to 15)	Displays whether the control circuit capacitor, main circuit capacitor, cooling fan, and each parts of the inrush current limit circuit has reached the life alarm output level or not. Reading only	
	256		Inrush current limit circuit life display	1%	100%	(0 to 100%)	Displays the deterioration degree of the inrush current limit circuit. Reading only	
	257		Control circuit capacitor life display	1%	100%	(0 to 100%)	Displays the deterioration degree of the control circuit capacitor. Reading only	
	258		Main circuit capacitor life display	1%	100%	(0 to 100%)	Displays the deterioration degree of the main circuit capacitor. Reading only The value measured by *Pr. 259* is displayed.	
	259		Main circuit capacitor life measuring	1	0	0, 1	Setting "1" and turning the power supply off starts the measurement of the main circuit capacitor life. When the *Pr.259* value is "3" after powering on again, the measuring is completed. Read the deterioration degree in *Pr.258*.	

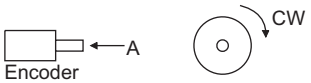
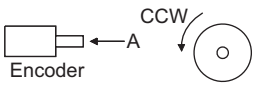
Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Operation at instantaneous power failure	261		Power failure stop selection	1	0	0	Coasting to stop When undervoltage or power failure occurs, the inverter output is shut off.	
						1	Without UV avoidance	When undervoltage or a power failure occurs, the inverter can be decelerated to a stop.
						11	With UV avoidance	
						2	Without UV avoidance	When undervoltage or a power failure occurs, the inverter can be decelerated to a stop. If power is restored during a power failure, the inverter accelerates again.
						12	With UV avoidance	
	262		Subtracted frequency at deceleration start	0.01Hz	3Hz	0 to 20Hz	Normally operation can be performed with the initial value unchanged. But adjust the frequency according to the magnitude of the load specifications (moment of inertia, torque).	
	263		Subtraction starting frequency	0.01Hz	60Hz	0 to 120Hz	When output frequency ≥ *Pr. 263* Decelerate from the speed obtained from output frequency - *Pr. 262*. When output frequency < *Pr. 263* Decelerate from output frequency	
						9999	Decelerate from the speed obtained from output frequency - *Pr. 262*.	
	264		Power-failure deceleration time 1	0.1/ 0.01s	5s	0 to 3600/ 360s	Set a deceleration slope down to the frequency set in *Pr. 266*.	
	265		Power-failure deceleration time 2	0.1/ 0.01s	9999	0 to 3600/ 360s	Set a deceleration slope below the frequency set in *Pr. 266*.	
						9999	Same slope as in *Pr. 264*	
	266		Power failure deceleration time switchover frequency	0.01Hz	60Hz	0 to 400Hz	Set the frequency at which the deceleration slope is switched from the *Pr. 264* setting to the *Pr. 265* setting.	
		294	UV avoidance voltage gain	0.1%	100%	0 to 200%	Adjust response level at UV avoidance operation. A larger setting will improve responsiveness to the bus voltage change.	
—	267		Refer to *Pr. 73*.					
	268		Refer to *Pr. 52*.					
	269		Parameter for manufacturer setting. Do not set.					
Load torque high speed frequency control	270		Stop-on contact/load torque high-speed frequency control selection	1	0	0	Without stop-on contact control and load torque high-speed frequency control	
						1	Stop-on contact control	
						2	Load torque high speed frequency control	
						3	Stop-on contact + load torque high speed frequency control	
	271		High-speed setting maximum current	0.1%	50%	0 to 220%	Set the upper and lower limits of the current at high and middle speeds.	
	272		Middle-speed setting minimum current	0.1%	100%	0 to 220%		
	273		Current averaging range	0.01Hz	9999	0 to 400Hz	Average current during acceleration from (*Pr. 273* × 1/ 2)Hz to (*Pr. 273*)Hz can be achieved.	
						9999	Average current during acceleration from (*Pr. 5* × 1/ 2)Hz to (*Pr. 5*)Hz is achieved.	
	274		Current averaging filter time constant	1	16	1 to 4000	Set the time constant of the primary delay filter relative to the output current. (The time constant [ms] is 0.75 × *Pr. 274* and the initial value is 12ms.) A larger setting provides higher stability but poorer response.	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Stop-on contact control (Sensorless, Magnetic flux)	270		Stop-on contact/load torque high-speed frequency control selection	1	0	0	Without stop-on contact control and load torque high-speed frequency control
						1	Stop-on contact control
						2	Load torque high speed frequency control
						3	Stop-on contact + load torque high speed frequency control
	275		Stop-on contact excitation current low-speed multiplying factor	0.1%	9999	0 to 1000%	Usually set a value between 130% and 180%. Set the force (holding torque) for stop-on-contact control.
						9999	No compensation.
	276		PWM carrier frequency at stop-on contact	1	9999	0 to 9	Set a PWM carrier frequency for stop-on-contact control. (Valid at the output frequency of 3Hz or less.)
						9999	As set in *Pr. 72 PWM frequency selection*.
Brake sequence function (Vector, Sensorless, Magnetic flux)	278		Brake opening frequency	0.01Hz	3Hz	0 to 30Hz	Set to the rated slip frequency of the motor + about 1.0Hz. This parameter may be only set if *Pr. 278* ≤ *Pr. 282*.
	279		Brake opening current	0.1%	130%	0 to 220%	Generally, set this parameter to about 50 to 90%. If the setting is too low, the load is liable to drop due to gravity at start. Suppose that the rated inverter current is 100%.
	280		Brake opening current detection time	0.1s	0.3s	0 to 2s	Generally, set this parameter to about 0.1 to 0.3s.
	281		Brake operation time at start	0.1s	0.3s	0 to 5s	*Pr. 292* = 7: Set the mechanical delay time until the brake is loosened. *Pr. 292* = 8: Set the mechanical delay time until the brake is loosened + about 0.1 to 0.2s.
	282		Brake operation frequency	0.01Hz	6Hz	0 to 30Hz	At this frequency, the brake opening request signal (BOF) is switched off. Generally, set this parameter to the *Pr. 278* setting + 3 to 4Hz. Setting is enabled only when *Pr. 282* ≥ *Pr. 278*.
	283		Brake operation time at stop	0.1s	0.3s	0 to 5s	*Pr. 292* = 7: Set the mechanical delay time until the brake is closed + 0.1s. *Pr. 292* = 8: Set the mechanical delay time until the brake is closed + about 0.2 to 0.3s.
	284		Deceleration detection function selection	1	0	0	Deceleration is not detected.
						1	If deceleration is not normal during deceleration operation, the inverter fault (E.MB2) is provided to trip the inverter and turn OFF the brake opening request signal (BOF).
	285		Overspeed detection frequency	0.01Hz	9999	0 to 30Hz	When brake sequence function is valid under encoder feedback control If (detected frequency) - (output frequency) > *Pr. 285* under encoder feedback control, the inverter fault (E.MB1) is provided to trip the inverter and turn OFF the brake opening request signal (BOF).
						9999	Overspeed is not detected.
		292	Automatic acceleration/ deceleration	1	0	0, 3, 5 to 8, 11	Brake sequence function is valid when a setting is "7 or 8".
Speed deviation excess detection (Vector)	285		Excessive speed deviation detection frequency	0.01Hz	9999	9999	Without speed deviation excessive
						0 to 30Hz	If the difference (absolute value) between the speed command value and actual speed exceeds the *Pr. 285 Speed deviation excess detection frequency* setting for longer than the time set in *Pr. 853 Speed deviation time* during speed control under vector control, speed deviation excessive occurs and error "E. OSD" appears, resulting in a stop.
		853	Speed deviation time	0.1s	1s	0 to 100s	

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Droop control (Vector / Sensorless / Magnetic flux)	286		Droop gain	0.1%	0%	0	Droop control is invalid	
						0.1 to 100%	Set the drooping amount at the rated torque as a percentage with respect to the rated frequency.	
	287		Droop filter time constant	0.01s	0.3s	0 to 1s	Set the time constant of the primary delay filter applied to the torque current.	
	288		Droop function activation selection	1	0		**Real sensor less vector / vector control**	**Advanced magnetic flux vector control**
						0, 10	Droop control is not exercised during acceleration/deceleration. (When *Pr.288* = 10, droop compensation amount is determined using the motor speed as reference.)	Droop control is not exercised during acceleration/ deceleration. Droop compensation amount is determined using the rated motor frequency as reference.
						1, 11	Droop control is always exercised during operation. (with 0 limit) (When *Pr.288* = 11, droop compensation amount is determined using the motor speed as reference.)	
						2	Droop control is always exercised during operation. (without 0 limit)	
Pulse train I/O	291		Pulse train I/O selection	1	0		**Input**	**Output**
						0	JOG terminal	FM output
						1	Pulse train input	FM output
						10	JOG terminal	Pulse train open collector output (50% duty)
						11	Pulse train input	
						20	JOG terminal	Pulse train open collector output (ON width is always same)
						21	Pulse train input	
						100		Pulse train open collector output (ON width is always same (independently of *Pr. 54*))
		384	Input pulse division scaling factor	1	0	0 to 250	Indicates division scaling factor to the input pulse and the frequency resolution to the input pulse changes according to the value.	
		385	Frequency for zero input pulse	0.01Hz	0	0 to 400Hz	Set the frequency when the input pulse is 0 (bias).	
		386	Frequency for maximum input pulse	0.01Hz	60Hz	0 to 400Hz	Set the frequency when the input pulse is maximum (gain).	
—	292, 293		Refer to *Pr. 61*.					
—	294		Refer to *Pr. 261*.					
	296		Password lock level	1	9999	0 to 6, 99, 100 to 106, 199	Select restriction level of parameter reading/ writing when a password is registered.	
						9999	No password lock	
	297		Password lock/unlock	1	9999	1000 to 9998	Register a 4-digit password	
						(0 to 5)*	Displays password unlock error count. (Reading only) (Valid when *Pr. 296* = "100" to "106, 199")	* "0 or 9999" can be set in *Pr. 297* at any time although the setting is invalid (the displayed value does not change).
						9999*	No password lock	
—	299		Refer to *Pr. 57*.					

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
RS-485 communication	331		RS-485 communication station number	1	0	0 to 31 (0 to 247)	Set the inverter station number. (same specifications as *Pr. 117*) When "1" (Modbus-RTU protocol) is set in *Pr. 551*, the setting range within parenthesis is applied.
	332		RS-485 communication speed	1	96	3, 6, 12, 24, 48, 96, 192, 384	Used to select the communication speed. (same specifications as *Pr. 118*)
	333		RS-485 communication stop bit length	1	1	0, 1, 10, 11	Select stop bit length and data length. (same specifications as *Pr. 119*)
	334		RS-485 communication parity check selection	1	2	0, 1, 2	Select the parity check specifications. (same specifications as *Pr. 120*)
	335		RS-485 communication retry count	1	1	0 to 10, 9999	Set the permissible number of retries at occurrence of a data receive error. (same specifications as *Pr. 121*)
	336		RS-485 communication check time interval	0.1s	0s	0	RS-485 communication can be made, but the inverter trips in the NET operation mode.
						0.1 to 999.8s	Set the communication check time interval. (same specifications as *Pr. 122*)
						9999	No communication check (signal loss detection)
	337		RS-485 communication waiting time setting	1	9999	0 to 150ms, 9999	Set the waiting time between data transmission to the inverter and response. (same specifications as *Pr. 123*)
	338		Communication operation command source	1	0	0	Start command source communication
						1	Start command source external
	339		Communication speed command source	1	0	0	Frequency command source communication
						1	Frequency command source external
						2	Frequency command source external (Frequency command from communication is valid, frequency command from terminal 2 is invalid)
	341		RS-485 communication CR/LF selection	1	1	0, 1, 2	Select presence/absence of CR/LF. (same specifications as *Pr. 124*)
	342		Communication EEPROM write selection	1	0	0	Parameter values written by communication are written to the EEPROM and RAM.
						1	Parameter values written by communication are written to the RAM.
	343		Communication error count	1	0	—	Displays the number of communication errors during Modbus-RTU communication. Read only. Displayed only when Modbus-RTU protocol is selected.
		539	Modbus-RTU communication check time interval	0.1s	9999	0	Modbus-RTU communication can be made, but the inverter trips in the NET operation mode.
						0.1 to 999.8s	Set the communication check time interval. (same specifications as *Pr. 122*)
						9999	No communication check (signal loss detection)
		549	Protocol selection	1	0	0	Mitsubishi inverter (computer link) protocol — After setting change, reset (switch power off, then on) the inverter. The setting change is reflected after a reset.
						1	Modbus-RTU protocol — After setting change, reset (switch power off, then on) the inverter. The setting change is reflected after a reset.
		550	NET mode operation command source selection	1	9999	0	The communication option is the command source when NET operation mode.
						1	RS-485 terminals are the command source when NET operation mode.
						9999	Automatic communication option recognition Normally, RS-485 terminals are the command source. When a communication option is mounted, the communication option is the command source.
		551	PU mode operation command source selection	1	2	1	RS-485 terminals are the command source when PU operation mode
						2	PU connector is the command source when PU operation mode.
						3	Select the USB connector as the PU operation mode control source.
—	340		Refer to *Pr. 79*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Orientation control (Vector, Magnetic flux, V/F)	350		Stop position command selection	1	9999	0	Internal stop position command *(Pr.356)*
						1	External stop position command (FR-A7AX 16-bit data)
						9999	Orientation control invalid
	351		Orientation speed	0.01Hz	2Hz	0 to 30Hz	Decrease the motor speed to the set value when the orientation command (X22) is given.
	352		Creep speed	0.01Hz	0.5Hz	0 to 10Hz	As soon as the current position pulse reaches the creep switchover position set in *Pr.353* after the speed has reached the orientation speed, the speed decelerates down to the creep speed set in *Pr.352*.
	353		Creep switchover position	1	511	0 to 16383	
	354		Position loop switchover position	1	96	0 to 8191	As soon as the current position pulse reaches the set position loop switchover position, control is changed to position loop.
	355		DC injection brake start position	1	5	0 to 255	After changed to position loop, DC injection brake is applied and the motor stops as soon as the current position pulse reaches the set DC injection brake start position.
	356		Internal stop position command	1	0	0 to 16383	When "0" is set in *Pr. 350*, the internal position command is activated and the setting value of *Pr. 356* becomes a stop position.
	357		Orientation in-position zone	1	5	0 to 255	Set the in-position zone at a stop of the orientation.
	358		Servo torque selection	1	1	0 to 13	Functions at orientation completion can be selected.
	359		Encoder rotation direction	1	1	0	 Clockwise direction as viewed from A is forward rotation
						1	 Counter clockwise direction as viewed from A is forward rotation
	360		16 bit data selection	1	0	0	Speed command
						1	Position command 16 bit data is used as external position command as is.
						2 to 127	Set the stop position dividing up to 128 stop positions at regular intervals.
							When 1 is set in *Pr.350* and the option FR-A7AX is mounted, set a stop position using 16-bit data. Stop position command is input as binary regardless of the *Pr.304* setting.
	361		Position shift	1	0	0 to 16383	Shift the origin using a compensation value without changing the origin of the encoder. The stop position is a position obtained by adding the setting value of *Pr. 361* to the position command.
	362		Orientation position loop gain	0.1	1	0.1 to 10	When servo torque function is selected using *Pr.358*, output frequency for generating servo torque increases to the creep speed of *Pr.352* gradually according to the slope set in *Pr.362*. Although the operation becomes faster when the value is increased, a machine may hunt, etc.

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Orientation control Vector Magnetic flux V/F	363		Completion signal output delay time	0.1s	0.5s	0 to 5s	The orientation complete signal (ORA) is output delaying the set time after in-position zone is entered. Also, the signal turns off delaying the set time after in-position zone is out.
	364		Encoder stop check time	0.1s	0.5s	0 to 5s	Orientation fault signal (ORM) is output when the encoder remains stopped for the set time without orientation completion in the state where no orientation complete signal (ORA) is output. ORM signal is output when orientation is not completed again in the set time in the state where ORA signal is output.
	365		Orientation limit	1s	9999	0 to 60s	Measure the time taken after passing the creep switchover position and output the orientation fault signal (ORM) if orientation is not completed within the set time.
						9999	Set to 120s.
	366		Recheck time	0.1s	9999	0 to 5s	Turning off the start signal with orientation command (X22) on after stopping the motor by orientation control, the present position is checked again after the set time elapses and the orientation complete signal (ORA) or orientation fault signal (ORM) is output.
						9999	Not checked.
		369	Number of encoder pulses	1	1024	0 to 4096	Set the number of pulses of the encoder. Set the number of pulses before multiplied by four.
		393	Orientation selection	1	0	0	Orientation is executed from the current rotation direction.
						1	Orientation is executed from the forward rotation direction.
						2	Orientation is executed from the reverse rotation direction.
		396	Orientation speed gain (P term)	1	60	0 to 1000	Servo rigidity is (response level during position control loop) at orientation stop can be adjusted.
		397	Orientation speed integral time	0.001s	0.333s	0 to 20.0s	
		398	Orientation speed gain (D term)	0.1%	1%	0 to 100.0%	Lag/advance compensation gain can be adjusted.
		399	Orientation deceleration ratio	1	20	0 to 1000	Make adjustment when the motor runs back at orientation stop or the orientation time is long.
Encoder feedback control Magnetic flux V/F	359		Encoder rotation direction	1	1	0	 Clockwise direction as viewed from A is forward rotation
						1	 Counter clockwise direction as viewed from A is forward rotation
	367		Speed feedback range	0.01Hz	9999	0 to 400Hz	Set the range of speed feedback control.
						9999	Encoder feedback control is invalid
	368		Feedback gain	0.1	1	0 to 100	Set when the rotation is unstable or response is slow.
	369		Number of encoder pulses	1	1024	0 to 4096	Set the number of pulses of the encoder. Set the number of pulses before multiplied by four.
Overspeed detection	374		Overspeed detection level	0.01Hz	140Hz	0 to 400Hz	When the motor speed reaches or exceeds the speed set in *Pr.374* during encoder feedback control, Real sensorless vector control, or vector control, over speed (E.OS) occurs and stops the inverter output.

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Encoder signal loss detection (Vector, Magnetic flux, V/F)	376		Encoder signal loss detection enable/disable selection	1	0	0	Signal loss detection is invalid
						1	Signal loss detection is valid When the cable of the encoder signal is broken during encoder feedback control, orientation control, or vector control, signal loss detection (E.ECT) is activated to stop the inverter output.
—	380 to 383		Refer to *Pr. 29*.				
	384 to 386		Refer to *Pr. 291*.				
Position control (Vector)	419		Position command source selection	1	0	0	Simple position control function by contact input
						1	Position command using pulse train input (FR-A7AL)
						2	Simple position pulse train command by pulse train input from the JOG terminal
	420		Command pulse scaling factor numerator	1	1	0 to 32767	Set the electronic gear. *Pr. 420* is a numerator and *Pr. 421* is a denominator.
	421		Command pulse scaling factor denominator	1	1	0 to 32767	
	422		Position loop gain	1s^{-1}	25s^{-1}	0 to 150s^{-1}	Set the gain of the position loop.
	423		Position feed forward gain	1%	0%	0 to 100%	Function to cancel a delay caused by the droop pulses of the deviation counter.
	424		Position command acceleration/ deceleration time constant	0.001s	0s	0 to 50s	Used when rotation has become unsmooth at a large electronic gear ratio (about 10 times or more) and low speed.
	425		Position feed forward command filter	0.001s	0s	0 to 5s	Enters the primary delay filter in response to the feed forward command.
	426		In-position width	1 pulse	100 pulse	0 to 32767 pulse	The in-position signal (Y36) turns on when the droop pulses become less than the setting.
	427		Excessive level error	1	40K	0 to 400K	A position error excessive (E.OD) occurs when the droop pulses exceed the setting.
						9999	Function invalid
	428		Command pulse selection	1	0	0 to 2	Pulse train + rotation signal sign — Negative logic
						3 to 5	Pulse train + rotation signal sign — Positive logic
	429		Clear signal selection	1	1	0	Deviation counter is cleared at trailing edge (at the moment when H level is changed to L level)
						1	eviation counter is cleared at L level
	430		Pulse monitor selection	1	9999	**Description**	**FR-DU07(FR-PU04/FR-PU07) display**
						0	The cumulative command pulse value is displayed. — Lower 4(5) digits
						1	Upper 4(5) digits
						2	The cumulative feedback pulse value is displayed. — Lower 4(5) digits
						3	Upper 4(5) digits
						4	The droop pulses are monitored. — Lower 4(5) digits
						5	Upper 4(5) digits
						9999	Frequency monitor is displayed.
		464	Digital position control sudden stop deceleration time	0.1s	0	0 to 360.0s	Set the time until the inverter stops when the forward rotation (reverse rotation) command is turned OFF with the position feed forward function.
—	450		Refer to *Pr. 71*.				
	451		Refer to *Pr. 80*.				
	453, 454		Refer to *Pr. 80*.				
	455 to 463		Refer to *Pr. 82*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
							Selection Method	Position Feed Speed
Simple position feed function Vector	465		First position feed amount lower 4 digits	1	0	0 to 9999	RH	High speed *(Pr.4)*
	466		First position feed amount upper 4 digits	1	0	0 to 9999		
	467		Second position feed amount lower 4 digits	1	0	0 to 9999	RM	Middle speed *(Pr.5)*
	468		Second position feed amount upper 4 digits	1	0	0 to 9999		
	469		Third position feed amount lower 4 digits	1	0	0 to 9999	RL	Low speed *(Pr.6)*
	470		Third position feed amount upper 4 digits	1	0	0 to 9999		
	471		Fourth position feed amount lower 4 digits	1	0	0 to 9999	RM, RL	Speed 4 *(Pr.24)*
	472		Fourth position feed amount upper 4 digits	1	0	0 to 9999		
	473		Fifth position feed amount lower 4 digits	1	0	0 to 9999	RH, RL	Speed 5 *(Pr.25)*
	474		Fifth position feed amount upper 4 digits	1	0	0 to 9999		
	475		Sixth position feed amount lower 4 digits	1	0	0 to 9999	RH, RM	Speed 6 *(Pr.26)*
	476		Sixth position feed amount upper 4 digits	1	0	0 to 9999		
	477		Seventh position feed amount lower 4 digits	1	0	0 to 9999	RH, RM, RL	Speed 7 *(Pr.27)*
	478		Seventh position feed amount upper 4 digits	1	0	0 to 9999		
	479		Eighth position feed amount lower 4 digits	1	0	0 to 9999	REX	Speed 8 *(Pr.232)*
	480		Eighth position feed amount upper 4 digits	1	0	0 to 9999		
	481		Ninth position feed amount lower 4 digits	1	0	0 to 9999	REX, RL	Speed 9 *(Pr.233)*
	482		Ninth position feed amount upper 4 digits	1	0	0 to 9999		
	483		Tenth position feed amount lower 4 digits	1	0	0 to 9999	REX, RM	Speed 10 *(Pr.234)*
	484		Tenth position feed amount upper 4 digits	1	0	0 to 9999		
	485		Eleventh position feed amount lower 4 digits	1	0	0 to 9999	REX, RM, RL	Speed 11 *(Pr.235)*
	486		Eleventh position feed amount upper 4 digits	1	0	0 to 9999		
	487		Twelfth position feed amount lower 4 digits	1	0	0 to 9999	REX, RH	Speed 12 *(Pr.236)*
	488		Twelfth position feed amount upper 4 digits	1	0	0 to 9999		
	489		Thirteenth position feed amount lower 4 digits	1	0	0 to 9999	REX, RH, RL	Speed 13 *(Pr.237)*
	490		Thirteenth position feed amount upper 4 digits	1	0	0 to 9999		
	491		Fourteenth position feed amount lower 4 digits	1	0	0 to 9999	REX, RH, RM	Speed 14 *(Pr.238)*
	492		Fourteenth position feed amount upper 4 digits	1	0	0 to 9999		
	493		Fifteenth position feed amount lower 4 digits	1	0	0 to 9999	REX, RH, RM, RL	Speed 15 *(Pr.239)*
	494		Fifteenth position feed amount upper 4 digits	1	0	0 to 9999		

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description	
Remote output function (REM signal)	495		Remote output selection	1	0	0	Remote output data clear at power OFF	Remote output data is cleared during an inverter reset
						1	Remote output data retention at power OFF	
						10	Remote output data clear at power OFF	Remote output data is retained during an inverter reset
						11	Remote output data retention at power OFF	
	496		Remote output data 1	1	0	0 to 4095	Output terminal can be switched on and off.	
	497		Remote output data 2	1	0	0 to 4095		
Maintenance of parts	503		Maintenance timer	1	0	0 (1 to 9998)	Displays the cumulative energization time of the inverter in 100h increments. Reading only Writing the setting of "0" clears the cumulative energization time.	
	504		Maintenance timer alarm output set time	1	9999	0 to 9998	Set the time taken until when the maintenance timer alarm output signal (Y95) is output.	
						9999	No function	
—	505		Refer to *Pr. 37*.					
—	516 to 519		Refer to *Pr. 29*.					
	539		Refer to *Pr. 343*.					
Inverter setup using USB communication	547		USB communication station number	1	0	0 to 31	Specify the inverter station number.	
	548		USB communication check time interval	0.1s	9999	0	USB communication is enabled. However, the inverter will come to an alarm stop (E. USB) if operation is changed to PU operation mode.	
						0.1 to 999.8s	Set the interval of communication check time.	
						9999	No communication check	
		551	Refer to *Pr. 338 and Pr. 339*.					
	549 to 551		Refer to *Pr. 343*.					
Current average value monitor signal	555		Current average time	0.1s	1s	0.1 to 1.0s	Set the time taken to average the current during start bit output (1s).	
	556		Data output mask time	0.1s	0s	0.0 to 20.0s	Set the time for not obtaining (mask) transient state data.	
	557		Current average value monitor signal output reference current	0.01A	Rated inverter current	0 to 500A	Set the reference (100%) for outputting the signal of the current average value.	
—	563, 564		Refer to *Pr. 52*.					
	569		Refer to *Pr. 80*.					
	571		Refer to *Pr. 13*.					
	574		Refer to *Pr. 95*.					
	575 to 577		Refer to *Pr. 127*.					
	611		Refer to *Pr. 57*.					
	665		Refer to *Pr. 882*.					
	684		Refer to *Pr. 82*.					
	800		Refer to *Pr. 81*.					
	802		Refer to *Pr. 10*.					
	803		Refer to *Pr. 22*.					

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Torque command source selection Vector Sensorless	804		Torque command source selection	1	0	0	Torque command by terminal 1 analog input
						1	Torque command by parameter *Pr.805* or *Pr.806* setting (-400% to 400%)
						2	Torque command using pulse train input (FR-A7AL)
						3	Torque command by using CC-Link (FR-A7NC)
						4	Digital input from the option (FR-A7AX)
						5	Torque command by using CC-Link (FR-A7NC)
						6	
	805		Torque command value (RAM)	1%	1000%	600 to 1400%	Digital setting of the torque command can be made by setting *Pr. 805* or *Pr. 806*. (Setting from communication option, etc. can be made.) In this case, set the speed limit value to an appropriate value to prevent overspeed.
	806		Torque command value (RAM,EEPROM)	1%	1000%	600 to 1400%	
Speed limit Vector Sensorless	807		Speed limit selection	1	0	0	Use the speed command value during speed control as speed limit.
						1	According to *Pr. 808* and *Pr. 809*, set the speed limit in forward and reverse rotation directions individually.
						2	The analog voltage of the terminal 1 input is used to make speed limit. For 0 to 10V input, set the forward rotation speed limit. (The reverse rotation speed limit is *Pr. 1 Maximum frequency*) For -10 to 0V input, set the reverse rotation speed limit. (The forward rotation speed limit is *Pr. 1 Maximum frequency*.) The maximum frequency of both the forward and reverse rotations is *Pr. 1 Maximum frequency*.
	808		Forward rotation speed limit	0.01Hz	60Hz	0 to 120Hz	Set the speed limit level during forward rotation. (valid when *Pr. 807* = 1)
	809		Reverse rotation speed limit	0.01Hz	9999	0 to 120Hz	Set the speed limit level during reverse rotation. (valid when *Pr. 807* = 1)
						9999	The setting is the same as that of the torque limit in the forward rotation direction.
—	810		Refer to *Pr. 22*.				
—	811		Refer to *Pr. 22* and *Pr. 37*.				
—	812 to 817		Refer to *Pr. 22*.				
Easy gain tuning selection Vector Sensorless	818		Easy gain tuning response level setting	1	2	1 to 15	1 : Slow response ↓ 15 : Fast response
	819		Easy gain tuning selection	1	0	0	No tuning
						1	With load estimation (only under vector control) — The optimum gain is automatically set from the torque command and speed during motor operation.
						2	Manual input of load (*Pr. 880*) — The optimum gain is automatically set from the torque command and speed during motor operation.
Speed loop proportional gain setting Vector Sensorless	820		Speed control P gain 1	1%	60%	0 to 1000%	Set the proportional gain for speed control. (Increasing the value improves trackability in response to a speed command change and reduces speed variation with disturbance.)
		830	Speed control P gain 2	1%	9999	0 to 1000%	Second function of *Pr. 820* (valid when RT signal is on)
						9999	No function
Speed control integral time setting Vector Sensorless	821		Speed control integral time 1	0.001s	0.333s	0 to 20s	Set the integral time during speed control. (Decrease the value to shorten the time taken for returning to the original speed if speed variation with disturbance occurs.)
		831	Speed control integral time 2	0.001s	9999	0 to 20s	Second function of *Pr. 821* (valid when the RT terminal is on)
						9999	No function
—	822		Refer to *Pr. 74*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Speed detection filter function (Vector)	823		Speed detection filter 1	0.001s	0.001s	0 to 0.1s	Set the primary delay filter for the speed feedback.
		833	Speed detection filter 2	0.001s	9999	0 to 0.1s	Second function of *Pr. 823* (valid when RT signal is on)
						9999	No function
Current loop proportional gain setting (Vector, Sensorless)	824		Torque control P gain 1	1%	100%	0 to 200%	Set the proportional gain for the current control of the q and d axes. (Increasing the value improves trackability in response to a current command change and reduces current variation with disturbance.)
		834	Torque control P gain 2	1%	9999	0 to 200%	Second function of *Pr. 824* (valid when the RT terminal is on)
						9999	No function
Current control integral time setting (Vector, Sensorless)	825		Torque control integral time 1	0.1ms	5ms	0 to 500ms	Set the integral time for the current control of the q and d axes. (Decreasing the value shortens the time taken to return to the original torque if current variation with disturbance occurs.)
		835	Torque control integral time 2	0.1ms	9999	0 to 500ms	Second function of *Pr. 825* (valid when the RT signal is on)
						9999	No function
—	826		Refer to *Pr. 74*.				
Torque detection filter function (Vector, Sensorless)	827		Torque detection filter 1	0.001s	0s	0 to 0.1s	Set the primary delay filter for the current feedback.
		837	Torque detection filter 2	0.001s	9999	0 to 0.1s	Second function of *Pr. 827* (valid when the RT signal is on)
						9999	No function
Speed feed forward control, model adaptive speed control (Vector, Sensorless)	828		Model speed control gain	1%	60%	0 to 1000%	Set the gain for model speed controller.
		877	Speed feed forward control/ model adaptive speed control selection	1	0	0	Normal speed control is exercised
						1	Speed feed forward control is exercised.
						2	Model adaptive speed control is enabled.
		878	Speed feed forward filter	0.01s	0s	0 to 1s	Set the primary delay filter for the speed feed forward result calculated using the speed command and load inertia ratio.
		879	Speed feed forward torque limit	0.1%	150%	0 to 400%	Limits the maximum value of the speed feed forward torque.
		880	Load inertia ratio	0.1	7	0 to 200 times	Set the load inertia ratio. Inertia ratio found by easy gain turning.
		881	Speed feed forward gain	1%	0%	0 to 1000%	Set the feed forward calculation result as a gain.
—	830		Refer to *Pr. 820*.				
	831		Refer to *Pr. 821*.				
	832		Refer to *Pr. 74*.				
	833		Refer to *Pr. 823*.				
	834		Refer to *Pr. 824*.				
	835		Refer to *Pr. 825*.				
	836		Refer to *Pr. 74*.				
	837		Refer to *Pr. 827*.				

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Torque bias function Vector	840		Torque bias selection	1	9999	0	Set the contact signal (X42, X43) based-torque bias amount using *Pr.841* to *Pr.843*.
						1	Set the terminal 1-based torque bias amount as desired in *C16* to *C19*. (forward rotation)
						2	Set the terminal 1-based torque bias amount as desired in *C16* to *C19*. (reverse rotation)
						3	The terminal 1-based torque bias amount can be set automatically in *C16* to *C19*, *Pr.846* according to the load.
						9999	Without torque bias, rated torque 100%
	841		Torque bias 1	1%	9999	600 to 999%	Negative torque bias amount (-400% to -1%)
	842		Torque bias 2			1000 to 1400%	Positive torque bias amount (0% to 400%)
	843		Torque bias 3			9999	Without torque bias setting
	844		Torque bias filter	0.001s	9999	0 to 5s	Time until torque rises.
						9999	Same operation as when 0s is set.
	845		Torque bias operation time	0.01s	9999	0 to 5s	Time for maintaining torque equivalent to the torque bias amount.
						9999	Same operation as when 0s is set.
	846		Torque bias balance compensation	0.1V	9999	0 to 10V	Set the voltage under balanced load.
						9999	Same operation as when 0V is set.
	847		Fall-time torque bias terminal 1 bias	1%	9999	0 to 400%	Set the bias value of the torque command.
						9999	Same as at a rise time (*C16*, *C17*).
	848		Fall-time torque bias terminal 1 gain	1%	9999	0 to 400%	Set the gain value of the torque command.
						9999	Same as at a rise time (*C18*, *C19*).
—	849		Refer to *Pr. 74*.				
	850		Refer to *Pr. 10*.				
	853		Refer to *Pr. 285*.				
Excitation ratio Vector Sensorless	854		Excitation ratio	1%	100%	0 to 100%	Set the excitation ratio under no load.
Function assignment of analog input terminal	858		Terminal 4 function assignment	1	0	0	Frequency/speed command
						1	Magnetic flux command
						4	Stall prevention/torque limit
						9999	No function
		868	Terminal 1 function assignment	1	0	0	Frequency setting auxiliary
						1	Magnetic flux command
						2	Regenerative torque limit
						3	Torque command
						4	Stall prevention/torque limit/torque command
						5	Forward/reverse rotation speed limit
						6	Torque bias
						9999	No function
—	859, 860		Refer to *Pr. 82*.				
Notch filter Vector	862		Notch filter time constant	1	0	0 to 60	You can use the mechanical resonance speed to make this setting to reduce the response level of the mechanical resonance frequency band, avoiding mechanical resonance.
Sensorless	863		Notch filter depth	1	0	0	Deep (-40dB)
						1	↑ (-14dB)
						2	↓ (-8dB)
						3	Sharrow (-4dB)

Function	Parameter	Related parameters	Name	Increments	Initial Value	Range	Description
Torque detection Vector Sensorless	864		Torque detection	0.1%	150%	0 to 400%	You can make setting to output a signal if the motor torque exceeds the predetermined value.
—	865		Refer to *Pr. 41*.				
	866		Refer to *Pr. 55*.				
	867		Refer to *Pr. 52*.				
	868		Refer to *Pr. 858*.				
—	872		Refer to *Pr. 251*.				
Speed limit during speed control Vector	873		Speed limit	0.01Hz	20Hz	0 to 120Hz	Frequency is limited at the set frequency + *Pr.873* during vector control.
—	874		Refer to *Pr. 22*.				
Fault definition	875		Fault definition	1	0	0	At occurrence of any fault, output is shut off immediately. At this time, the fault output also turns on.
						1	At occurrence of external thermal operation (OHT), electronic thermal relay function (THM) or PTC thermistor function (PTC) fault, the motor is decelerated to a stop. At occurrence of fault other than OHT, THM and PTC, trips immediately. Same operation as when "0" is set is performed under position control.
—	877 to 881		Refer to *Pr. 828*.				
Regeneration avoidance function	882		Regeneration avoidance operation selection	1	0	0	Regeneration avoidance function invalid
						1	Regeneration avoidance function is always valid
						2	Regeneration avoidance function is valid only at constant speed
	883		Regeneration avoidance operation level	0.1V	380/760VDC *	300 to 800V	Set the bus voltage level at which regeneration avoidance operates. When the bus voltage level is set to low, overvoltage error will be less apt to occur. However, the actual deceleration time increases. The set value must be higher than the power supply voltage × $\sqrt{2}$ * The initial value differs according to the voltage level. (200V class / 400V class)
	884		Regeneration avoidance at deceleration detection sensitivity	1	0	0	Regeneration avoidance by bus voltage change ratio is invalid
						1 to 5	Set sensitivity to detect the bus voltage change. Setting: 1 → 5 Detection sensitivity: Low → High
	885		Regeneration avoidance compensation frequency limit value	0.01Hz	6Hz	0 to 10Hz	Set the limit value of frequency which rises at activation of regeneration avoidance function.
						9999	Frequency limit invalid
	886		Regeneration avoidance voltage gain	0.1%	100%	0 to 200%	Adjust responsiveness at activation of regeneration avoidance. Setting a larger value in *Pr.886* will improve responsiveness to the bus voltage change. However, the output frequency could become unstable. When vibration is not suppressed by decreasing the *Pr.886* setting, set a smaller value in *Pr.665*.
		665	Regeneration avoidance frequency gain	0.1%	100%	0 to 200%	
Free parameter	888		Free parameter 1	1	9999	0 to 9999	Parameters you can use for your own purposes. Used for maintenance, management, etc. by setting a unique number to each inverter when multiple inverters are used.
	889		Free parameter 2	1	9999	0 to 9999	
—	891		Refer to *Pr. 52*.				

Function	Parameter / Related parameters	Name	Increments	Initial Value	Range	Description
Energy saving monitor	892	Load factor	0.1%	100%	30 to 150%	Set the load factor for commercial power supply operation. This value is used to calculate the power consumption estimated value during commercial power supply operation.
	893	Energy saving monitor reference (motor capacity)	0.01kW	Rated inverter capacity	0.1 to 55kW	Set the motor capacity (pump capacity). Set when calculating power saving rate and average power saving rate value.
	894	Control selection during commercial power supply operation	1	0	0	Discharge damper control (fan)
					1	Inlet damper control (fan)
					2	Valve control (pump)
					3	Commercial power-supply drive (fixed value)
	895	Power saving rate reference value	1	9999	0	Consider the value during commercial power-supply operation as 100%
					1	Consider the *Pr. 893* setting as 100%.
					9999	No function
	896	Power unit cost	0.01	9999	0 to 500	Set the power unit cost. Displays the power saving rate on the energy saving monitor
					9999	No function
	897	Power saving monitor average time	1h	9999	0	Average for 30 minutes
					1 to 1000h	Average for the set time
					9999	No function
	898	Power saving cumulative monitor clear	1	9999	0	Cumulative monitor value clear
					1	Cumulative monitor value hold
					10	Cumulative monitor continue (communication data upper limit 9999)
					9999	Cumulative monitor continue (communication data upper limit 65535)
	899	Operation time rate (estimated value)	0.1%	9999	0 to 100%	Use for calculation of annual power saving amount. Set the annual operation ratio (consider 365 days × 24hr as 100%).
					9999	No function
Adjustment of terminal FM and AM (calibration)	C0 (900)	FM terminal calibration	—	—	—	Calibrate the scale of the meter connected to terminal FM. (Only when *Pr. 291* = 0, 1)
	C1 (901)	AM terminal calibration	—	—	—	Calibrate the scale of the analog meter connected to terminal AM.
—	C2(902) to C7(905)	Refer to *Pr. 125 and Pr. 126*.				
Adjustment of analog input speed limit (calibration)	C12 (917)	Terminal 1 bias frequency (speed)	0.01Hz	0Hz	0 to 400Hz	Set the frequency on the bias side of terminal 1 input. (valid when *Pr.868* = 5)
	C13 (917)	Terminal 1 bias (speed)	0.1%	0%	0 to 300%	Set the converted % of the bias side voltage (current) of terminal 1 input. (valid when *Pr.868* = 5)
	C14 (918)	Terminal 1 gain frequency (speed)	0.01Hz	60Hz	0 to 400Hz	Set the frequency of terminal 1 input gain (maximum). (valid when *Pr.868* = 5)
	C15 (918)	Terminal 1 gain (speed)	0.1%	100%	0 to 300%	Set the converted % of the gain side voltage (current) of terminal 1 input. (valid when *Pr.868* = 5)

Function	Parameter / Related parameters	Name	Increments	Initial Value	Range	Description
Adjustment of analog input torque magnetic flux command (calibration)	C16 (919)	Terminal 1 bias command (torque/magnetic flux)	0.1%	0%	0 to 400%	Set the torque/magnetic flux command value on the bias side of terminal 1 input. (valid when *Pr. 868* ≠ 0, 5)
	C17 (919)	Terminal 1 bias (torque/ magnetic flux)	0.1%	0%	0 to 300%	Set the converted % of the bias side voltage (current) of terminal 1 input. (valid when *Pr. 868* ≠ 0, 5)
	C18 (920)	Terminal 1 gain command (torque/magnetic flux)	0.1%	150%	0 to 400%	Set the torque/magnetic flux command value on the gain side of terminal 1 input. (valid when *Pr. 868* ≠ 0, 5)
	C19 (920)	Terminal 1 gain (torque/ magnetic flux)	0.1%	100%	0 to 300%	Set the converted % of the gain side voltage (current) of terminal 1 input. (valid when *Pr. 868* ≠ 0, 5)
	C38 (932)	Terminal 4 bias command (torque/magnetic flux)	0.1%	0%	0 to 400%	Set the torque/magnetic flux command value on the bias side of terminal 4 input. (valid when *Pr. 858* = 1, 4)
	C39 (932)	Terminal 4 bias (torque/ magnetic flux)	0.1%	20%	0 to 300%	Set the converted % of the bias side current (voltage) of terminal 4 input. (valid when *Pr. 858* = 1, 4)
	C40 (933)	Terminal 4 gain command (torque/magnetic flux)	0.1%	150%	0 to 400%	Set the torque/magnetic flux command value on the bias side of terminal 4 input. (valid when *Pr. 858* = 1, 4)
	C41 (933)	Terminal 4 gain (torque/ magnetic flux)	0.1%	100%	0 to 300%	Set the converted % of the gain side current (voltage) of terminal 4 input. (valid when *Pr. 858* = 1, 4)
—	989	Parameter for manufacturer setting. Do not set.				
Buzzer control of the operation panel	990	PU buzzer control	1	1	0	Without buzzer
					1	With buzzer
PU contrast adjustment	991	PU contrast adjustment	1	58	0 to 63	Contrast adjustment of the LCD of the parameter unit (FR-PU04/FR-PU07) can be performed. 0 (Light) → 63 (Dark)
Parameter clear, parameter copy	Pr.CL	Parameter clear	1	0	0, 1	Setting "1" returns all parameters except calibration parameters to the initial values.
	ALLC	All parameter clear	1	0	0, 1	Setting "1" returns all parameters to the initial values.
	Er.CL	Faults history clear	1	0	0, 1	Setting "1" will clear eight past faults.
	PCPY	Parameter copy	1	0	0	Cancel
					1	Read the source parameters to the operation panel.
					2	Write the parameters copied to the operation panel to the destination inverter.
					3	Verify parameters in the inverter and operation panel.

The parameter number in parentheses is the one for use with the parameter unit (FR-PU04/FR-PU07).

5 TROUBLESHOOTING

When a fault occurs in the inverter, the inverter trips and the PU display automatically changes to one of the following fault or alarm indications.
If the fault does not correspond to any of the following faults or if you have any other problem, please contact your sales representative.

- Retention of fault output signal .. When the magnetic contactor (MC) provided on the input side of the inverter is opened when a fault occurs, the inverter's control power will be lost and the fault output will not be held.
- Fault or alarm indication ..... When a fault or alarm occurs, the operation panel display automatically switches to the fault or alarm indication.
- Resetting method ..... When a fault occurs, the inverter output is kept stopped. Unless reset, therefore, the inverter cannot restart. *(Refer to page 141)*
- When any fault occurs, take the appropriate corrective action, then reset the inverter, and resume operation. Not doing so may lead to the inverter fault and damage.

Inverter fault or alarm indications are roughly categorized as below.

(1) Error message
A message regarding operational fault and setting fault by the operation panel (FR-DU07) and parameter unit (FR-PU04 /FR-PU07) is displayed. The inverter does not trip.

(2) Warning
The inverter does not trip even when a warning is displayed. However, failure to take appropriate measures will lead to a fault.

(3) Alarm
The inverter does not trip. You can also output an alarm signal by making parameter setting.

(4) Fault
When a fault occurs, the inverter trips and a fault signal is output.

REMARKS

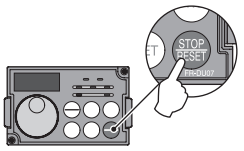
· Past eight faults can be displayed using the setting dial. (Refer to *page 160* for the operation.)

5.1 Reset method of protective function

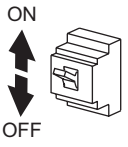
(1) Resetting the inverter

The inverter can be reset by performing any of the following operations. Note that the internal thermal integrated value of the electronic thermal relay function and the number of retries are cleared (erased) by resetting the inverter.
Inverter recovers about 1s after the reset is released.

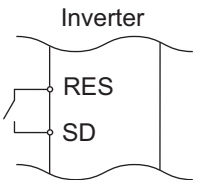
Operation 1: ..... Using the operation panel, press STOP RESET to reset the inverter.
(This may only be performed when a fault occurs (Refer to *page 147* for fault.))



Operation 2: ..... Switch power OFF once. After the indicator of the operation panel turns OFF, switch it ON again.



Operation 3: ..... Turn ON the reset signal (RES) for more than 0.1s. (If the RES signal is kept ON, "Err." appears (flickers) to indicate that the inverter is in a reset status.)



CAUTION

· OFF status of the start signal must be confirmed before resetting the inverter fault. Resetting inverter fault with the start signal ON restarts the motor suddenly.

5.2 List of fault or alarm display

Operation Panel Indication			Name	Refer to
Error message	E - - -	E - - -	Faults history	160
	HOLd	HOLD	Operation panel lock	143
	LOCd	LOCd	Password locked	143
	Er1 to Er4	Er1 to 4	Parameter write error	143
	rE1 to rE4	rE1 to 4	Copy operation error	144
	Err.	Err.	Error	145
Warning	OL	OL	Stall prevention (overcurrent)	145
	oL	oL	Stall prevention (overvoltage)	145
	TH	TH	Electronic thermal relay function prealarm	146
	PS	PS	PU stop	146
	MT	MT	Maintenance signal output	146
	CP	CP	Parameter copy	146
	SL	SL	Speed limit indication (Output during speed limit)	146
Alarm	FN	FN	Fan alarm	147
Fault	E.OC1	E.OC1	Overcurrent trip during acceleration	147
	E.OC2	E.OC2	Overcurrent trip during constant speed	148
	E.OC3	E.OC3	Overcurrent trip during deceleration or stop	148
	E.OV1	E.OV1	Regenerative overvoltage trip during acceleration	149
	E.OV2	E.OV2	Regenerative overvoltage trip during constant speed	149
	E.OV3	E.OV3	Regenerative overvoltage trip during deceleration or stop	149
	E.THT	E.THT	Inverter overload trip (electronic thermal relay function)	150
	E.THM	E.THM	Motor overload trip (electronic thermal relay function)	150
	E.FIN	E.FIN	Heatsink overheat	150
	E.IPF	E.IPF	Instantaneous power failure	151
	E.UVT	E.UVT	Undervoltage	151
	E.ILF	E.ILF*	Input phase loss	151
	E.OLT	E.OLT	Stall prevention stop	151
	E. GF	E.GF	Output side earth (ground) fault overcurrent	152
	E. LF	E.LF	Output phase loss	152
	E.OHT	E.OHT	External thermal relay operation *2	152

Operation Panel Indication			Name	Refer to
Fault	E.PTC	E.PTC*	PTC thermistor operation	152
	E.OPT	E.OPT	Option fault	153
	E.OP3	E.OP3	Communication option fault	153
	E. 1 to E. 3	E. 1 to E. 3	Option fault	153
	E. PE	E.PE	Parameter storage device fault	153
	E.PUE	E.PUE	PU disconnection	154
	E.rET	E.RET	Retry count excess	154
	E.PE2	E.PE2*	Parameter storage device fault	154
	E. 5 E. 6 E. 7 E.CPU	E. 5 E. 6 E. 7 E.CPU	CPU fault	154
	E.CTE	E.CTE	Operation panel power supply short circuit, RS-485 terminal power supply short circuit	154
	E.P24	E.P24	24VDC power output short circuit	156
	E.CdO	E.CDO*	Output current detection value exceeded	156
	E.IOH	E.IOH*	Inrush current limit circuit fault	156
	E.SEr	E.SER*	Communication fault (inverter)	157
	E.AIE	E.AIE*	Analog input fault	157
	E. OS	E.OS	Overspeed occurrence	155
	E.OSd	E.OSD	Speed deviation excess detection	155
	E.ECT	E.ECT	Signal loss detection	155
	E. Od	E.OD	Excessive position fault	156
	E.MB1 to E.MB7	E.MB1 to E.MB7	Brake sequence fault	155
	E.EP	E.EP	Encoder phase fault	156
	E.USB	E.USB*	USB communication fault	157
	E. 4	E.4	Converter overcurrent	157
	E. 8	E.8	Power supply fault	157
	E. 10	E.10	Converter transistor protection thermal operation (electronic thermal)	158
	E. 11	E.11	Opposite rotation deceleration fault	158
	E. 13	E.13	Internal circuit fault	158
	E. 15	E.15	Converter circuit fault	158

* If an error occurs when using the FR-PU04, "Fault 14" is displayed on the FR-PU04.

5.3 Causes and corrective actions

(1) Error message

A message regarding operational troubles is displayed. Output is not shut off.

Operation Panel Indication	HOLD	HOLd
Name	Operation panel lock	
Description	Operation lock mode is set. Operation other than STOP RESET is invalid. *(Refer to page 50.)*	
Check point	—	
Corrective action	Press MODE for 2s to release lock.	

Operation Panel Indication	LOCd	LOCd
Name	Password locked	
Description	Password function is active. Display and setting of parameter is restricted.	
Check point	—	
Corrective action	Enter the password in *Pr. 297 Password lock/unlock* to unlock the password function before operating. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*	

Operation Panel Indication	Er1	Er 1
Name	Write disable error	
Description	• You attempted to make parameter setting when *Pr. 77 Parameter write selection* has been set to disable parameter write. • Frequency jump setting range overlapped. • Adjustable 5 points V/F settings overlapped • The PU and inverter cannot make normal communication	
Check point	• Check the setting of *Pr. 77 Parameter write selection (Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check the settings of *Pr. 31 to 36 (frequency jump). (Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check the settings of *Pr. 100 to Pr. 109 (adjustable 5 points V/F). (Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check the connection of the PU and inverter.	

Operation Panel Indication	Er2	Er2
Name	Write error during operation	
Description	When parameter write was performed during operation with a value other than "2" (writing is enabled independently of operating status in any operation mode) is set in *Pr. 77* and the STF (STR) is on.	
Check point	• Check the *Pr. 77* setting. *(Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check that the inverter is not operating.	
Corrective action	• Set "2" in *Pr. 77*. • After stopping operation, make parameter setting.	

Operation Panel Indication	Er3	Er3
Name	Calibration error	
Description	Analog input bias and gain calibration values are too close.	
Check point	Check the settings of C3, C4, C6 and C7 (calibration functions). *(Refer to Chapter 4 of the Instruction Manual (Applied).)*	

Operation Panel Indication	Er4	Er4
Name	Mode designation error	
Description	• You attempted to make parameter setting in the NET operation mode when *Pr. 77* is not "2". • Appears if a parameter setting is attempted in the External or NET operation mode with *Pr. 77* ≠ "2". • Appears if a parameter setting is attempted when the command source is not at the operation panel. (FR-DU07).	
Check point	• Check that operation mode is "PU operation mode". • Check the *Pr. 77* setting. *(Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check the *Pr. 551* setting.	
Corrective action	• After setting the operation mode to "PU operation mode", make parameter setting. *(Refer to page 62.)* • After setting *Pr. 77* = "2", make parameter setting. • Set *Pr. 551* = "2 (initial setting)". (*Refer to Chapter 4 of the Instruction Manual (Applied)*.)	

Operation Panel Indication	rE1	rE1
Name	Parameter read error	
Description	An error occurred in the EEPROM on the operation panel side during parameter copy reading.	
Check point	—	
Corrective action	• Make parameter copy again. *(Refer to page 54.)* • Check for an operation panel (FR-DU07) failure. Please contact your sales representative.	

Operation Panel Indication	rE2	rE2
Name	Parameter write error	
Description	• You attempted to perform parameter copy write during operation. • An error occurred in the EEPROM on the operation panel side during parameter copy writing.	
Check point	Is the FWD or REV LED of the operation panel (FR-DU07) lit or flickering?	
Corrective action	• After stopping operation, make parameter copy again. *(Refer to page 54.)* • Check for an operation panel (FR-DU07) failure. Please contact your sales representative.	

Operation Panel Indication	rE3	rE3
Name	Parameter verification error	
Description	• Data on the operation panel side and inverter side are different. • An error occurred in the EEPROM on the operation panel side during parameter verification.	
Check point	Check for the parameter setting of the source inverter and inverter to be verified.	
Corrective action	• Press SET to continue verification. Make parameter verification again. *(Refer to page 55.)* • Check for an operation panel (FR-DU07) failure. Please contact your sales representative.	

Operation Panel Indication	rE4	rE4
Name	Model error	
Description	• A different model was used for parameter write and verification during parameter copy. • When parameter copy write is stopped after parameter copy read is stopped	
Check point	• Check that the verified inverter is the same model. • Check that the power is not turned OFF or an operation panel is not disconnected, etc. during parameter copy read.	
Corrective action	• Use the same model (FR-A701 series) for parameter copy and verification. • Perform parameter copy read again.	

Operation Panel Indication	Err.	Err.
Description	• The RES signal is ON • The PU and inverter cannot make normal communication (contact fault of the connector) • When the voltage drops in the inverter's input side. • When the control circuit power (R1/L11, S1/L21) and the main circuit power (R/L1, S/L2, T/L3) are connected to a separate power, it may appear at turning ON of the main circuit. It is not a fault.	
Corrective action	• Turn OFF the RES signal. • Check the connection of the PU and inverter. • Check the voltage on the inverter's input side.	

(2) Warning

When the protective circuit is activated, the output is not shut off.

Operation Panel Indication	OL	OL	FR-PU04 FR-PU07	OL
Name	Stall prevention (overcurrent)			
Description	During acceleration	When the output current (output torque during Real sensorless vector control or vector control) of the inverter exceeds the stall prevention operation level (*Pr. 22 Stall prevention operation level*, etc.), this function stops the increase in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current has decreased below stall prevention operation level, this function increases the frequency again.		
	During constant speed operation	When the output current (output torque during Real sensorless vector control or vector control) of the inverter exceeds the stall prevention operation level (*Pr. 22 Stall prevention operation level*, etc.), this function reduces frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current has decreased below stall prevention operation level, this function increases the frequency up to the set value.		
	During deceleration	When the output current (output torque during Real sensorless vector control or vector control) of the inverter exceeds the stall prevention operation level (*Pr. 22 Stall prevention operation level*, etc.), this function stops the decrease in frequency until the overload current decreases to prevent the inverter from resulting in overcurrent trip. When the overload current has decreased below stall prevention operation level, this function decreases the frequency again.		
Check point	• Check that the *Pr. 0 Torque boost* setting is not too large. • Check that the *Pr. 7 Acceleration time* and *Pr. 8 Deceleration time* settings are not too small. • Check that the load is not too heavy. • Are there any failure in peripheral devices? • Check that the *Pr. 13 Starting frequency* is not too large. · Check the motor for use under overload. • Check that the *Pr. 22 Stall prevention operation level* is appropriate.			
Corrective action	• Increase or decrease the *Pr. 0 Torque boost* value 1% by 1% and check the motor status. *(Refer to page 59.)* • Set a larger value in *Pr. 7 Acceleration time* and *Pr. 8 Deceleration time*. *(Refer to page 61.)* • Reduce the load weight. • Try Advanced magnetic flux vector control, Real sensorless vector control or vector control. • Change the *Pr. 14 Load pattern selection* setting. • Set stall prevention operation current in *Pr. 22 Stall prevention operation level*. (The initial value is 150%.) The acceleration/deceleration time may change. Increase the stall prevention operation level with *Pr. 22 Stall prevention operation level*, or disable stall prevention with *Pr. 156 Stall prevention operation selection*. (Use *Pr. 156* to set either operation continued or not at OL operation.)			

Operation Panel Indication	oL	oL	FR-PU04 FR-PU07	oL
Name	Stall prevention (overvoltage)			
Description	During deceleration	• If the regenerative energy of the motor becomes excessive and exceeds the regenerative energy consumption capability, this function stops the decrease in frequency to prevent overvoltage trip. As soon as the regenerative energy has decreased, deceleration resumes. • If the regenerative energy of the motor becomes excessive when regeneration avoidance function is selected (*Pr. 882* = 1), this function increases the speed to prevent overvoltage trip. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*		
Check point	• Check for sudden speed reduction. • Regeneration avoidance function *(Pr. 882 to Pr. 886)* is being used? *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			
Corrective action	The deceleration time may change. Increase the deceleration time using *Pr. 8 Deceleration time*.			

Operation Panel Indication	PS	PS	FR-PU04 FR-PU07	PS
Name	PU stop			
Description	Stop with STOP RESET of the PU is set in *Pr. 75 Reset selection/disconnected PU detection/PU stop selection*. (For *Pr. 75*, refer to *Chapter 4 of the Instruction Manual (Applied)*.)			
Check point	Check for a stop made by pressing STOP RESET of the operation panel.			
Corrective action	Turn the start signal off and release with PU EXT.			

Operation Panel Indication	TH	TH	FR-PU04 FR-PU07	TH
Name	Electronic thermal relay function prealarm			
Description	Appears if the cumulative value of the *Pr. 9 Electronic thermal O/L relay* reaches or exceeds 85% of the preset level. If it reaches 100% of the *Pr. 9 Electronic thermal O/L relay* setting, a motor overload trip (E. THM) occurs. The THP signal can be simultaneously output with the [TH] display. For the terminal used for the THP signal output, assign the function by setting "8" (positive logic) or "108" (negative logic) in any of *Pr. 190 to Pr. 196 (output terminal function selection)*. *(Refer to Chapter 4 of the Instruction Manual (Applied))*			
Check point	• Check for large load or sudden acceleration. • Is the *Pr. 9 Electronic thermal O/L relay* setting is appropriate? *(Refer to page 57.)*			
Corrective action	• Reduce the load weight or the number of operation times. • Set an appropriate value in *Pr. 9 Electronic thermal O/L relay*. *(Refer to page 57.)*			

Operation Panel Indication	MT	MT	FR-PU04	———
			FR-PU07	MT
Name	Maintenance signal output			
Description	Indicates that the cumulative energization time of the inverter has reached a given time. When the setting of *Pr. 504 Maintenance timer alarm output set time* is the initial value (*Pr. 504* = "9999"), this protective function does not function.			
Check point	The *Pr. 503 Maintenance timer* setting is larger than the *Pr. 504 Maintenance timer alarm output set time* setting. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			
Corrective action	Setting "0" in *Pr. 503 Maintenance timer* erases the signal.			

Operation Panel Indication	CP	CP	FR-PU04	———
			FR-PU07	CP
Name	Parameter copy			
Description	Displayed when parameters are copied between the FR-A701 series and FR-A700 series 75K or higher.			
Check point	Check that parameters are not copied between the FR-A701 series and FR-A700 series 75K or higher.			
Corrective action	Copy between the same FR-A701 series.			

Operation Panel Indication	SL	SL	FR-PU04	———
			FR-PU07	SL
Name	Speed limit indication (output during speed limit)			
Description	Output if the speed limit level is exceeded during torque control.			
Check point	• Check that the torque command is not larger than required. • Check that the speed limit level is not low.			
Corrective action	• Decrease the torque command. • Increase the speed limit level.			

(3) Alarm
When an alarm occurs, the output is not shut off. You can also output an alarm signal by making parameter setting. (Set "98" in any of *Pr. 190 to Pr. 196 (output terminal function selection)*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*)

Operation Panel Indication	FN	Fn	FR-PU04 FR-PU07	FN
Name	Fan alarm			
Description	For the inverter that contains a cooling fan, Fn appears on the operation panel when the cooling fan stops due to a fault or different operation from the setting of *Pr. 244 Cooling fan operation selection*.			
Check point	Check the cooling fan for a fault.			
Corrective action	Check for fan fault. Please contact your sales representative.			

(4) Fault
When a fault occurs, the inverter trips and a fault signal is output.

Operation Panel Indication	E.OC1	E.OC 1	FR-PU04 FR-PU07	OC During Acc
Name	Overcurrent trip during acceleration			
Description	When the inverter output current reaches or exceeds approximately 220% of the rated current during acceleration, the protective circuit is activated to stop the inverter output.			
Check point	• Check for sudden acceleration. • Check that the downward acceleration time is not long for lift. • Check for output short circuit. • Check that the *Pr. 3 Base frequency* setting is not 60Hz when the motor rated frequency is 50Hz. • Check if the stall prevention operation level is set too high. • Check if the fast-response current limit operation is disabled. • Check that the regeneration is not performed frequently. (Check that the output voltage becomes larger than the V/F reference voltage at regeneration and overcurrent due to increase in motor current occurs.) • Check that the power supply for RS-485 terminal is not shorted. (under vector control) • Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. • Check if a start command is given to the inverter while the motor is coasting.			
Corrective action	• Increase the acceleration time. (Shorten the downward acceleration time for lift.) • When "E.OC1" is always lit at starting, disconnect the motor once and start the inverter. If "E.OC1" is still lit, contact your sales representative. • Check the wiring to make sure that output short circuit does not occur. • Set the *Pr. 3 Base frequency* to 50Hz. *(Refer to page 58.)* • Lower the setting of stall prevention operation level. *(Refer to Chapter 4 of the Instruction Manual (Applied).)* • Activate the fast-response current limit operation. • Set base voltage (rated voltage of the motor, etc.) in *Pr. 19 Base frequency voltage*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check RS-485 terminal connection. (under vector control) • Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. • Input a start command after the motor stops. Alternatively, set the automatic restart after instantaneous power failure/flying start function. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			

Operation Panel Indication	E.OC2	E.OC2	FR-PU04 FR-PU07	Stedy Spd OC
Name	Overcurrent trip during constant speed			
Description	When the inverter output current reaches or exceeds approximately 220% of the rated current during constant speed operation, the protective circuit is activated to stop the inverter output.			
Check point	• Check for sudden load change. • Check for output short circuit. • Check if the stall prevention operation level is set too high. • Check if the fast-response current limit operation is disabled. • Check that the power supply for RS-485 terminal is not shorted. (under vector control) • Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. • Check if a start command is given to the inverter while the motor is coasting.			
Corrective action	• Keep load stable. • Check the wiring to make sure that output short circuit does not occur. • Lower the setting of stall prevention operation level. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied).)* • Activate the fast-response current limit operation. • Check RS-485 terminal connection. (under vector control) • Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. • Input a start command after the motor stops. Alternatively, set the automatic restart after instantaneous power failure/flying start function. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied).)*			

Operation Panel Indication	E.OC3	E.OC3	FR-PU04 FR-PU07	OC During Dec
Name	Overcurrent trip during deceleration or stop			
Description	When the inverter output current reaches or exceeds approximately 220% of the rated inverter current during deceleration (other than acceleration or constant speed), the protective circuit is activated to stop the inverter output.			
Check point	• Check for sudden speed reduction. • Check for output short circuit. • Check for too fast operation of the motor's mechanical brake. • Check if the stall prevention operation level is set too high. • Check if the fast-response current limit operation is disabled. • Check that the power supply for RS-485 terminal is not shorted. (under vector control) • Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control. • Check if a start command is given to the inverter while the motor is coasting.			
Corrective action	• Increase the deceleration time. • Check the wiring to make sure that output short circuit does not occur. • Check the mechanical brake operation. • Lower the setting of stall prevention operation level. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied).)* • Activate the fast-response current limit operation. • Check RS-485 terminal connection. (under vector control) • Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. • Input a start command after the motor stops. Alternatively, set the automatic restart after instantaneous power failure/flying start function. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied))*			

Operation Panel Indication	E.OV1	E.0u 1	FR-PU04 FR-PU07	OV During Acc
Name	Regenerative overvoltage trip during acceleration			
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. Protective circuit may activate even if the regeneration converter is not activated due to power supply failure (Input phase failure and instantaneous power failure).			
Check point	• Check for power supply fault or wrong wiring. • Check for too slow acceleration. (e.g. during descending acceleration in vertical lift load) • Check that the *Pr. 22 Stall prevention operation level* is not lower than the no load current.			
Corrective action	• Perform wiring correctly. • Decrease the acceleration time. • Use regeneration avoidance function *(Pr. 882 to Pr. 886). (Refer to Chapter 4 of the Instruction Manual (Applied).)* • Set a value larger than the no load current in *Pr. 22 Stall prevention operation level*.			

Operation Panel Indication	E.OV2	E.0u2	FR-PU04 FR-PU07	Stedy Spd OV
Name	Regenerative overvoltage trip during constant speed			
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. Protective circuit may activate even if the regeneration converter is not activated due to power supply failure (Input phase failure and instantaneous power failure).			
Check point	• Check for power supply fault or wrong wiring. • Check for sudden load change. • Check that the *Pr. 22 Stall prevention operation level* is not lower than the no load current.			
Corrective action	• Perform wiring correctly. • Keep load stable. • Use regeneration avoidance function *(Pr. 882 to Pr. 886). (Refer to Chapter 4 of the Instruction Manual (Applied).)* • Set a value larger than the no load current in *Pr. 22 Stall prevention operation level*.			

Operation Panel Indication	E.OV3	E.0u3	FR-PU04 FR-PU07	OV During Dec
Name	Regenerative overvoltage trip during deceleration or stop			
Description	If regenerative energy causes the inverter's internal main circuit DC voltage to reach or exceed the specified value, the protective circuit is activated to stop the inverter output. The circuit may also be activated by a surge voltage produced in the power supply system. Protective circuit may activate even if the regeneration converter is not activated due to power supply failure (Input phase failure and instantaneous power failure).			
Check point	• Check for power supply fault or wrong wiring. • Check for sudden speed reduction.			
Corrective action	• Perform wiring correctly. • Increase the deceleration time. (Set the deceleration time which matches the moment of inertia of the load) • Decrease the braking duty. • Use regeneration avoidance function *(Pr. 882 to Pr. 886). (Refer to Chapter 4 of the Instruction Manual (Applied).)*			

Operation Panel Indication	E.THT	E.THT	FR-PU04 FR-PU07	Inv. Overload
Name	Inverter overload trip (electronic thermal relay function) *1			
Description	If a current not less than 150% of the rated output current flows and overcurrent trip does not occur (220% or less), the electronic thermal relay activate to stop the inverter output in order to protect the output transistors. (Overload capacity 150% 60s inverse-time characteristics)			
Check point	• Check that acceleration/deceleration time is not too short. • Check that torque boost setting is not too large (small). • Check that load pattern selection setting is appropriate for the load pattern of the using machine. • Check the motor for use under overload.			
Corrective action	• Increase acceleration/deceleration time. • Adjust the torque boost setting. • Set the load pattern selection setting according to the load pattern of the using machine. • Reduce the load weight.			

Operation Panel Indication	E.THM	E.THM	FR-PU04 FR-PU07	Motor Ovrload
Name	Motor overload trip (electronic thermal relay function) *1			
Description	The electronic thermal relay function in the inverter detects motor overheat due to overload or reduced cooling capability during constant speed operation and pre-alarm (TH display) is output when the I^2t value reaches 85% of the *Pr. 9 Electronic thermal O/L relay* setting and the protection circuit is activated to stop the inverter output when the I^2t value reaches the specified value. When running a special motor such as a multi-pole motor or two motors, provide a thermal relay on the inverter output side since such motor(s) cannot be protected by the electronic thermal relay function.			
Check point	• Check the motor for use under overload. • Check that the setting of *Pr. 71 Applied motor* for motor selection is correct. *(Refer to Chapter 4 of the Instruction Manual (Applied).)* • Check that stall prevention operation setting is correct.			
Corrective action	• Reduce the load weight. • For a constant-torque motor, set the constant-torque motor in *Pr. 71 Applied motor*. • Check that stall prevention operation setting is correct. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			

*1 Resetting the inverter initializes the internal thermal integrated data of the electronic thermal relay function.

Operation Panel Indication	E.FIN	E.FIN	FR-PU04 FR-PU07	H/Sink O/Temp
Name	Heatsink overheat			
Description	If the heatsink overheats, the temperature sensor is actuated to stop the inverter output. The FIN signal can be output when the temperature becomes approximately 85% of the heatsink overheat protection operation temperature. For the terminal used for the FIN signal output, assign the function by setting "26" (positive logic) or "126" (negative logic) in any of *Pr. 190 to Pr. 196 (output terminal function selection)*. *(Refer to Chapter 4 of the Instruction Manual (Applied))*			
Check point	• Check for too high surrounding air temperature. • Check for heatsink clogging. • Check that the cooling fan is stopped. (Check that FN is displayed on the operation panel.)			
Corrective action	• Set the surrounding air temperature to within the specifications. • Clean the heatsink. • Replace the cooling fan.			

Operation Panel Indication	E.IPF	E.1 PF	FR-PU04 FR-PU07	Inst. Pwr. Loss
Name	Instantaneous power failure			
Description	If a power failure occurs for longer than 15ms (this also applies to inverter input shut-off), the instantaneous power failure protective function is activated to trip the inverter in order to prevent the control circuit from malfunctioning. If a power failure persists for longer than 100ms, the fault output is not provided, and the inverter restarts if the start signal is on upon power restoration. (The inverter continues operating if an instantaneous power failure is within 15ms.) In some operating status (load magnitude, acceleration/deceleration time setting, etc.), overcurrent or other protection may be activated upon power restoration. When instantaneous power failure protection is activated, the IPF signal is output. *(Refer to Chapter 4 of the Instruction Manual (Applied))*			
Check point	Find the cause of instantaneous power failure occurrence.			
Corrective action	• Remedy the instantaneous power failure. • Prepare a backup power supply for instantaneous power failure. • Set the function of automatic restart after instantaneous power failure (*Pr. 57*). *(Refer to Chapter 4 of the Instruction Manual (Applied) .)*			

Operation Panel Indication	E.UVT	E.UuT	FR-PU04 FR-PU07	Under Voltage
Name	Undervoltage			
Description	If the power supply voltage of the inverter decreases, the control circuit will not perform normal functions. In addition, the motor torque will be insufficient and/or heat generation will increase. To prevent this, if the power supply voltage decreases below about 150VAC (300VAC for the 400V class), this function stops the inverter output. When undervoltage protection is activated, the IPF signal is output. *(Refer to Chapter 4 of the Instruction Manual (Applied))*			
Check point	Check for start of large-capacity motor.			
Corrective action	• Check the power supply system equipment such as the power supply. • If the problem still persists after taking the above measure, please contact your sales representative.			

Operation Panel Indication	E.ILF	E.1 LF	FR-PU04	Fault 14
			FR-PU07	Input phase loss
Name	Input phase loss			
Description	This fault is output when function valid setting (= 1) is set in *Pr. 872 Input phase loss protection selection* and one phase of the three phase power input is lost. (If the input power voltage is less than 100VAC, the inverter may detect an input phase loss (E.ILF).) *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			
Check point	Check for a break in the cable for the three-phase power supply input.			
Corrective action	• Wire the cables properly. • Repair a break portion in the cable. • Check the *Pr. 872 Input phase loss protection selection* setting.			

Operation Panel Indication	E.OLT	E.OLT	FR-PU04 FR-PU07	Stll Prev STP (OL shown during stall prevention operation)
Name	Stall prevention stop			
Description	If the frequency has fallen to 0.5Hz by stall prevention operation and remains for 3s, a fault (E.OLT) appears and trips the inverter. OL appears while stall prevention is being activated. When speed control is performed by Real sensorless vector control or vector control, a fault (E.OLT) is displayed and the inverter output is stopped if frequency drops to the *Pr. 865 Low speed detection* (initial value is 1.5Hz) setting by torque limit operation and the output torque exceeds *Pr. 874 OLT level setting* (initial value is 150%) setting and remains for more than 3s.			
Check point	• Check the motor for use under overload. *(Refer to Chapter 4 of the Instruction Manual (Applied) .)* • Check that the *Pr. 865 Low speed detection* and *Pr. 874 OLT level setting* values are correct. (Check the *Pr. 22 Stall prevention operation level* setting if V/F control is exercised.)			
Corrective action	• Reduce the load weight. • Change the *Pr. 22 Stall prevention operation level*, *Pr. 865 Low speed detection* and *Pr. 874 OLT level setting* values. (Check the *Pr. 22 Stall prevention operation level* setting if V/F control is exercised.)			

Operation Panel Indication	E.GF	E. GF	FR-PU04 FR-PU07	Ground Fault
Name	Output side earth (ground) fault overcurrent			
Description	This function stops the inverter output if an earth (ground) fault overcurrent flows due to an earth (ground) fault that occurred on the inverter's output (load) side.			
Check point	Check for an earth (ground) fault in the motor and connection cable.			
Corrective action	Remedy the earth (ground) fault portion.			

Operation Panel Indication	E.LF	E. LF	FR-PU04 FR-PU07	E. LF
Name	Output phase loss			
Description	This function stops the inverter output if one of the three phases (U, V, W) on the inverter's output side (load side) is lost.			
Check point	• Check the wiring (Check that the motor is normal.) • Check that the capacity of the motor used is not smaller than that of the inverter. • Check if a start command is given to the inverter while the motor is coasting.			
Corrective action	• Wire the cables properly. • Check the *Pr. 251 Output phase loss protection selection* setting. • Input a start command after the motor stops. Alternatively, set the automatic restart after instantaneous power failure/flying start function. *(Refer to Chapter 4 of 📖 the Instruction Manual (Applied).)*			

Operation Panel Indication	E.OHT	E.OHT	FR-PU04 FR-PU07	OH Fault
Name	External thermal relay operation			
Description	If the external thermal relay provided for motor overheat protection, or the internally mounted temperature relay in the motor, etc. switches on (contacts open), the inverter output is stopped. This function is available when "7" (OH signal) is set in any of *Pr. 178* to *Pr. 189 (input terminal function selection)*. When the initial value (without OH signal assigned) is set, this protective function is not available.			
Check point	• Check for motor overheating. • Check that the value of 7 (OH signal) is set correctly in any of *Pr. 178 to Pr. 189 (input terminal function selection)*.			
Corrective action	• Reduce the load and operating duty. • Even if the relay contacts are reset automatically, the inverter will not restart unless it is reset.			

Operation Panel Indication	E.PTC	E.PTC	FR-PU04	Fault 14
			FR-PU07	PTC activated
Name	PTC thermistor operation			
Description	Stops the inverter output when the motor overheat status is detected for 10s or more by the external PTC thermistor input connected to the terminal AU. This fault is available when "63" is set in *Pr. 184 AU terminal function selection* and AU/PTC switchover switch is set in PTC side. When the initial value (*Pr. 184* = "4") is set, this protective function is not available.			
Check point	• Check the connection between the PTC thermistor switch and thermal protector. • Check the motor for operation under overload. • Is valid setting (= 63) selected in *Pr. 184 AU terminal function selection* ? *(Refer to Chapter 4 of 📖 the Instruction Manual (Applied).)*			
Corrective action	Reduce the load weight.			

Operation Panel Indication	E.OPT	E.OPT	FR-PU04 FR-PU07	Option Fault
Name	Option fault			
Description	• Appears when torque command by the plug-in option is selected using *Pr.804 Torque command source selection* selection and no plug-in option is mounted. This function is available under Real sensorless vector control. • Appears when the switch for the manufacturer setting of the plug-in option is changed. • Appears when a communication option is connected while *Pr. 296* = "0 or 100."			
Check point	• Check that the plug-in option for torque command setting is connected. • Check for the password lock with a setting of *Pr. 296* = "0, 100"			
Corrective action	• Check for connection of the plug-in option. Check the *Pr. 804 Torque command source selection* setting. • Return the switch for the manufacturer setting of the plug-in option to the initial status. *(Refer to 🕮 instruction manual of each option)* • To apply the password lock when installing a communication option, set *Pr.296* ≠ "0,100". *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied).)*			

Operation Panel Indication	E.OP3	E.OP3	FR-PU04 FR-PU07	Option 3 Fault
Name	Communication option fault			
Description	Stops the inverter output when a communication line error occurs in the communication option.			
Check point	• Check for a wrong option function setting and operation. • Check that the plug-in option is plugged into the connector securely. • Check for a break in the communication cable. • Check that the terminating resistor is fitted properly.			
Corrective action	• Check the option function setting, etc. • Connect the plug-in option securely. • Check the connection of communication cable.			

Operation Panel Indication	E. 1 to E. 3	E. 1 to E. 3	FR-PU04 FR-PU07	Fault 1 to Fault 3
Name	Option fault			
Description	Stops the inverter output if a contact fault, etc. of the connector between the inverter and plug-in option occurs or if a communication option is fitted to the connector 1 or 2. Appears when the switch for the manufacturer setting of the plug-in option is changed.			
Check point	• Check that the plug-in option is plugged into the connector securely. (1 to 3 indicate the option connector numbers.) • Check for excess electrical noises around the inverter. • Check that the communication option is not fitted to the connector 1 or 2.			
Corrective action	• Connect the plug-in option securely. • Take measures against noises if there are devices producing excess electrical noises around the inverter. If the problem still persists after taking the above measure, please contact your sales representative or distributor. • Fit the communication option to the connector 3. • Return the switch for the manufacturer setting of the plug-in option to the initial status. *(Refer to 🕮 Instruction Manual of each option)*			

Operation Panel Indication	E.PE	E.PE	FR-PU04 FR-PU07	Corrupt Memry
Name	Parameter storage device fault (control circuit board)			
Description	Stops the inverter output if fault occurred in the parameter stored. (EEPROM failure)			
Check point	Check for too many number of parameter write times.			
Corrective action	Please contact your sales representative. When performing parameter write frequently for communication purposes, set "1" in *Pr. 342* to enable RAM write. Note that powering off returns the inverter to the status before RAM write.			

Operation Panel Indication	E.PE2	E.PE2	FR-PU04	Fault 14
			FR-PU07	PR storage alarm
Name	Parameter storage device fault (main circuit board)			
Description	Stops the inverter output if fault occurred in the parameter stored. (EEPROM failure)			
Check point	————————			
Corrective action	Please contact your sales representative.			

Operation Panel Indication	E.PUE	E.PUE	FR-PU04 FR-PU07	PU Leave Out
Name	PU disconnection			
Description	• This function stops the inverter output if communication between the inverter and PU is suspended, e.g. the operation panel and parameter unit is disconnected, when "2", "3", "16" or "17" was set in *Pr. 75 Reset selection/disconnected PU detection/PU stop selection*. • This function stops the inverter output when communication errors occurred consecutively for more than permissible number of retries when a value other than "9999" is set in *Pr. 121 Number of PU communication retries* during the RS-485 communication with the PU connector. • This function stops the inverter output if communication is broken within the period of time set in *Pr. 122 PU communication check time interval* during the RS-485 communication with the PU connector.			
Check point	• Check that the FR-DU07 or parameter unit (FR-PU04/FR-PU07) is fitted tightly. • Check the *Pr. 75* setting.			
Corrective action	Fit the FR-DU07 or parameter unit (FR-PU04/FR-PU07) securely.			

Operation Panel Indication	E.RET	E.rET	FR-PU04 FR-PU07	Retry No Over
Name	Retry count excess			
Description	If operation cannot be resumed properly within the number of retries set, this function trips the inverter. This function is available only when *Pr. 67 Number of retries at fault occurrence* is set. When the initial value (*Pr. 67* = "0") is set, this protective function is not available.			
Check point	Find the cause of alarm occurrence.			
Corrective action	Eliminate the cause of the error preceding this error indication.			

Operation Panel Indication	E. 5	E. 5	FR-PU04 FR-PU07	Fault 5
	E. 6	E. 6		Fault 6
	E. 7	E. 7		Fault 7
	E.CPU	E.CPU		CPU Fault
Name	CPU fault			
Description	Stops the inverter output if the communication error of the built-in CPU occurs.			
Check point	Check for devices producing excess electrical noises around the inverter.			
Corrective action	• Take measures against noises if there are devices producing excess electrical noises around the inverter. • Please contact your sales representative.			

Operation Panel Indication	E.CTE	E.CTE	FR-PU04	——
			FR-PU07	E.CTE
Name	Operation panel power supply short circuit, RS-485 terminal power supply short circuit			
Description	When the operation panel power supply (PU connector) is shorted, this function shuts off power output and stops the inverter output. At this time, the operation panel (parameter unit) cannot be used and RS-485 communication from the PU connector cannot be made. When the internal power supply for the RS-485 terminals are shorted, this function shuts off the power output. At this time, communication from the RS-485 terminals cannot be made. To reset, enter the RES signal or switch power off, then on again.			
Check point	• Check for a short circuit in the PU connector cable. • Check that the RS-485 terminals are connected correctly.			
Corrective action	• Check the PU and cable. • Check the connection of the RS-485 terminals			

Operation Panel Indication	E.MB1 to 7	E.MB1 to E.MB7	FR-PU04	——
			FR-PU07	E.MB1 Fault to E.MB7 Fault
Name	Brake sequence fault			
Description	The inverter output is stopped when a sequence error occurs during use of the brake sequence function (*Pr. 278* to *Pr. 285*). This fault is not available in the initial status (brake sequence function is invalid). *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			
Check point	Find the cause of alarm occurrence.			
Corrective action	Check the set parameters and perform wiring properly.			

Operation Panel Indication	E.OS	E. OS	FR-PU04 FR-PU07	E. OS
Name	Overspeed occurrence			
Description	Stops the inverter output when the motor speed exceeds the *Pr. 374 Overspeed detection level* during encoder feedback control Real sensorless vector control and vector control. This fault is not available in the initial status.			
Check point	• Check that the *Pr. 374 Overspeed detection level* value is correct. • Check that the number of encoder pulses does not differ from the actual number of encoder pulses.			
Corrective action	• Set the *Pr. 374 Overspeed detection level* value correctly. • Set the correct number of encoder pulses in *Pr. 369 Number of encoder pulses*.			

Operation Panel Indication	E.OSD	E.OSd	FR-PU04 FR-PU07	E. OSd
Name	Speed deviation excess detection			
Description	Stops the inverter output if the motor speed is increased or decreased under the influence of the load etc. during vector control with *Pr. 285 Speed deviation excess detection frequency* set and cannot be controlled in accordance with the speed command value. This fault is not available in the initial status.			
Check point	• Check that the values of *Pr. 285 Speed deviation excess detection frequency* and *Pr. 853 Speed deviation time* are correct. • Check for sudden load change. • Check that the number of encoder pulses does not differ from the actual number of encoder pulses.			
Corrective action	• Set *Pr. 285 Speed deviation excess detection frequency* and *Pr. 853 Speed deviation time* correctly. • Keep load stable. • Set the correct number of encoder pulses in *Pr. 369 Number of encoder pulses*.			

Operation Panel Indication	E.ECT	E.ECT	FR-PU04 FR-PU07	E. ECT
Name	Signal loss detection			
Description	Trips the inverter when the encoder signal is shut off under orientation control, encoder feedback control or vector control. This fault is not available in the initial status.			
Check point	• Check for the encoder signal loss. • Check that the encoder specifications are correct. • Check for a loose connector. • Check that the switch setting of the FR-A7AP/FR-A7AL (option) is correct. • Check that the power is supplied to the encoder. Or, check that the power is not supplied to the encoder later than the inverter.			
Corrective action	• Remedy the signal loss. • Use an encoder that meets the specifications. • Make connection securely. • Make a switch setting of the FR-A7AP/FR-A7AL (option) correctly. *(Refer to page 29)* • Supply the power to the encoder. Or supply the power to the encoder at the same time when the power is supplied to the inverter. If the power is supplied to the encoder after the inverter, check that the encoder signal is securely sent and set "0" in *Pr. 376*.			

Operation Panel Indication	E.OD	E. Od	FR-PU04 / FR-PU07	Fault 14 / E. Od
Name	Excessive position fault			
Description	Stops the inverter output when the difference between the position command and position feedback exceeds *Pr. 427 Excessive level error* under position control. This fault is not available in the initial status.			
Check point	• Check that the position detecting encoder mounting orientation matches the parameter. • Check that the load is not large. • Check that the *Pr. 427 Excessive level error* and *Pr. 369 Number of encoder pulses* are correct.			
Corrective action	• Check the parameters. • Reduce the load weight. • Set the *Pr. 427 Excessive level error* and *Pr. 369 Number of encoder pulses* correctly.			

Operation Panel Indication	E.EP	E.EP	FR-PU04 / FR-PU07	Fault 14 / E.EP
Name	Encoder phase fault			
Description	Stops the inverter output when the rotation command of the inverter differs from the actual motor rotation direction detected from the encoder. This fault is not available in the initial status.			
Check point	• Check for mis-wiring of the encoder cable. • Check for wrong setting of *Pr. 359 Encoder rotation direction*.			
Corrective action	• Perform connection and wiring securely. • Change the *Pr. 359 Encoder rotation direction* value.			

Operation Panel Indication	E.P24	E.P24	FR-PU04 / FR-PU07	E.P24
Name	24VDC power output short circuit			
Description	When the 24VDC power output from the PC terminal is shorted, this function shuts off the power output. At this time, all external contact inputs switch off. The inverter cannot be reset by entering the RES signal. To reset it, use the operation panel or switch power off, then on again.			
Check point	• Check for a short circuit in the PC terminal output.			
Corrective action	• Remedy the earth (ground) fault portion.			

Operation Panel Indication	E.CDO	E.CdO	FR-PU04 / FR-PU07	Fault 14 / OC detect level
Name	Output current detection value exceeded			
Description	Trips the inverter when the output current exceeds the setting of *Pr. 150 Output current detection level*. This function is available when *Pr. 167 Output current detection operation selection* is set to "1". When the initial value (*Pr. 167* = "0") is set, this protective function is not available.			
Check point	Check the settings of *Pr. 150 Output current detection level*, *Pr. 151 Output current detection signal delay time*, *Pr. 166 Output current detection signal retention time*, *Pr. 167 Output current detection operation selection*. *(Refer to Chapter 4 of the Instruction Manual (Applied).)*			

Operation Panel Indication	E.IOH	E.IOH	FR-PU04 / FR-PU07	Fault 14 / Inrush overheat
Name	Inrush current limit circuit fault			
Description	Stops the inverter output when the resistor of inrush current limit circuit overheated. The inrush current limit circuit failure			
Check point	• Check that frequent power ON/OFF is not repeated. • Check that the power supply circuit of inrush current limit circuit contactor is not damaged.			
Corrective action	Configure a circuit where frequent power ON/OFF is not repeated. If the problem still persists after taking the above measure, please contact your sales representative.			

Operation Panel Indication	E.SER	E.SEr	FR-PU04	Fault 14
			FR-PU07	VFD Comm error
Name	Communication fault (inverter)			
Description	This function stops the inverter output when communication error occurs consecutively for more than permissible retry count when a value other than "9999" is set in *Pr. 335 RS-485 communication retry count* during RS-485 communication from the RS-485 terminals. This function also stops the inverter output if communication is broken for the period of time set in *Pr. 336 RS-485 communication check time interval*.			
Check point	Check the RS-485 terminal wiring.			
Corrective action	Perform wiring of the RS-485 terminals properly.			

Operation Panel Indication	E.AIE	E.AI E	FR-PU04	Fault 14
			FR-PU07	Analog in error
Name	Analog input fault			
Description	Stops the inverter output when a 30mA or higher current or a 7.5V or higher voltage is input to terminal 2 while the current input is selected by *Pr.73 Analog input selection*, or to terminal 4 while the current input is selected by *Pr.267 Terminal 4 input selection*.			
Check point	Check the setting of *Pr. 73 Analog input selection*, *Pr. 267 Terminal 4 input selection* and voltage/current input switch. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied).)*			
Corrective action	Either give a frequency command by current input or set *Pr. 73 Analog input selection*, *Pr. 267 Terminal 4 input selection*, and voltage/current input switch to voltage input.			

Operation Panel Indication	E.USB	E.USb	FR-PU04	Fault 14
			FR-PU07	USB comm error
Name	USB communication fault			
Description	When the time set in *Pr. 548 USB communication check time interval* has broken, this function stops the inverter output.			
Check point	Check the USB communication cable.			
Corrective action	• Check the *Pr. 548 USB communication check time interval* setting. • Check the USB communication cable. • Increase the *Pr. 548 USB communication check time interval* setting. Or, change the setting to 9999. *(Refer to Chapter 4 of 🕮 the Instruction Manual (Applied))*			

Operation Panel Indication	E.4	E. 4	FR-PU04 FR-PU07	Fault 4
Name	Converter overcurrent			
Description	The current flows in the regeneration converter module exceeds the specified value, protective circuit activates and stops the inverter output.			
Check point	• Check that sudden acceleration/deceleration is not performed. • Check for sudden load change. • Check that wiring is correct. • Check that instantaneous power failure did not occur. • Check that the thyristor load does not exist in the same power supply system.			
Corrective action	• Increase acceleration/deceleration time. • Keep load stable. • Wire the cables properly. • When a thyristor load exist in the same power supply system, install an AC reactor (FR-HAL).			

Operation Panel Indication	E.8	E. 8	FR-PU04 FR-PU07	Fault 8
Name	Power supply fault			
Description	• When overvoltage occurs in the converter side during input phase failure detection • When overvoltage occurs in the converter side during instantaneous power failure detection • When fault of power supply frequency is detected • When phase shift is not detected When any of the above conditions applied, it is judged as power supply and the inverter output is stopped.			
Check point	Check the power supply and wiring.			
Corrective action	Perform wiring correctly.			

Operation Panel Indication	E.10	E. 10	FR-PU04 FR-PU07	Fault 10
Name	Converter transistor protection thermal operation (electronic thermal)			
Description	Current flowing in the module of the regeneration converter is less than the overcurrent shutoff level and exceeds the specified value, electronic thermal relay activates for protection and the inverter output is stopped.			
Check point	• Check the motor for use under overload. (excess regeneration amount) • Check that the thyristor load does not exist in the same power supply system.			
Corrective action	• Reduce the load weight. • When a thyristor load exists in the same power supply system, install an AC reactor (FR-HAL).			

Operation Panel Indication	E.11	E. 11	FR-PU04 FR-PU07	Fault 11
Name	Opposite rotation deceleration fault			
Description	The speed may not decelerate during low speed operation if the rotation direction of the speed command and the estimated speed differ when the rotation is changing from forward to reverse or from reverse to forward during torque control under Real sensorless vector control. At this time, the inverter output is stopped if the rotation direction will not change, causing overload. This fault is not available in the initial status (V/F control). (It is available only during Real sensorless vector control.)			
Check point	Check that the rotation direction is not switched from forward to reverse rotation (or from reverse to forward) during torque control under Real sensorless vector control.			
Corrective action	• Prevent the motor from switching the rotation direction from forward to reverse (or from reverse to forward) during torque control under Real sensorless vector control. • Please contact your sales representative.			

Operation Panel Indication	E.13	E. 13	FR-PU04 FR-PU07	Fault 13
Name	Internal circuit fault			
Description	Stop the inverter output when an internal circuit fault occurred.			
Corrective action	Please contact your sales representative.			

Operation Panel Indication	E.15	E. 15	FR-PU04 FR-PU07	Fault 15
Name	Converter circuit fault			
Description	• When a fault occurs in the peripheral circuit of the regeneration converter CPU • When a fault occurs in the control power supply circuit. • When a fault occurs in the inrush current limit circuit. If any of the above conditions applied, it is judged as converter circuit fault and the inverter output is stopped.			
Check point	Check for devices producing excess electrical noises around the inverter.			
Corrective action	• Take measures against noises if there are devices producing excess electrical noises around the inverter. • Please contact your sales representative.			

CAUTION

- If protective functions of E.ILF, E.PTC, E.PE2, E.EP, E.OD, E.CDO, E.IOH, E.SER, E.AIE, E.USB are activated when using the FR-PU04, "Fault 14" appears.
  Also when the faults history is checked on the FR-PU04, the display is "E.14".
- If faults other than the above appear, contact your sales representative.

5.4 Correspondences between digital and actual characters

There are the following correspondences between the actual alphanumeric characters and the digital characters displayed on the operation panel.

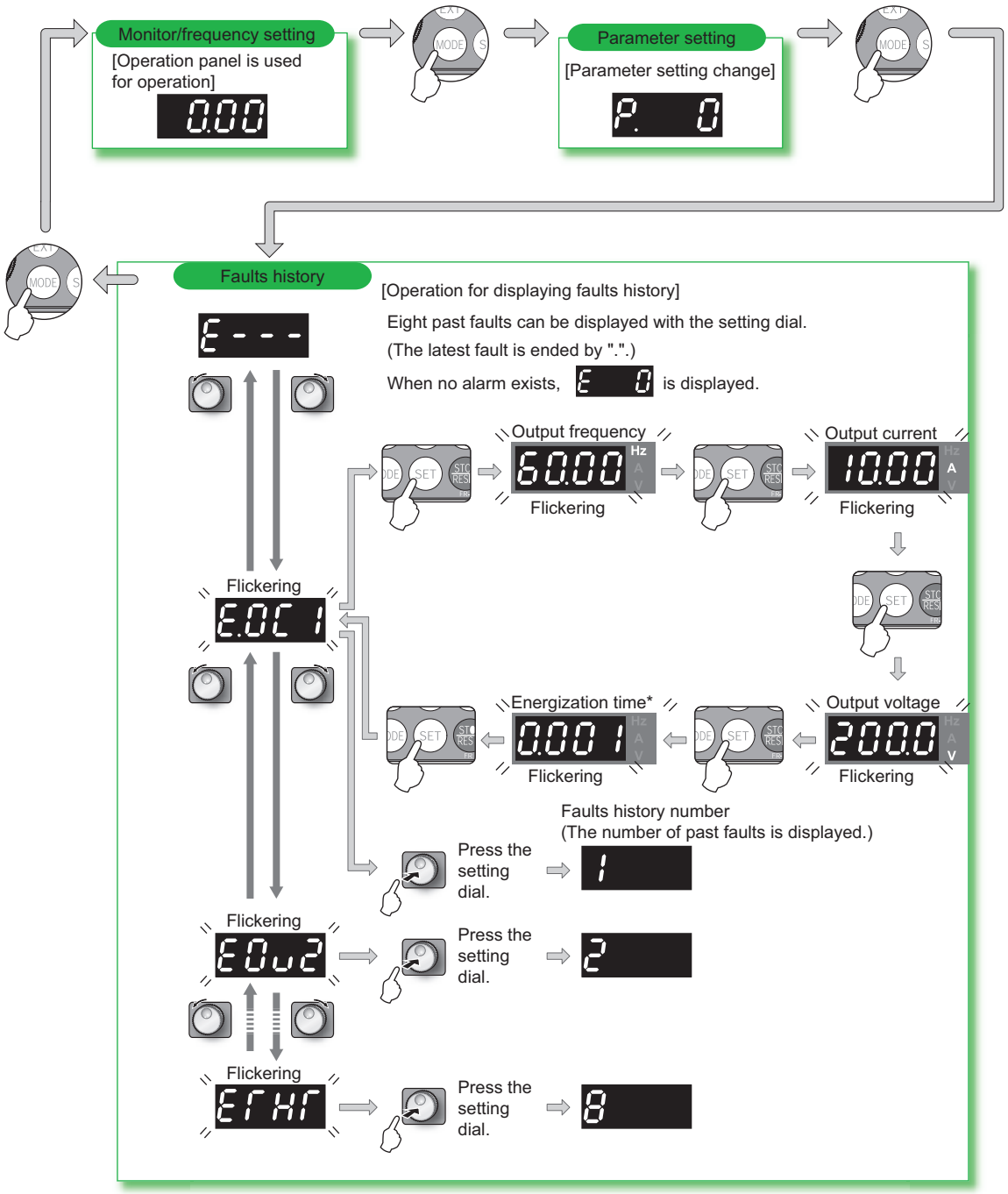
Actual	Digital
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Actual	Digital
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
L	

Actual	Digital
M	
N	
O	
o	
P	
S	
T	
U	
V	
r	
-	

5.5 Check and clear of the faults history

(1) Check for the faults history

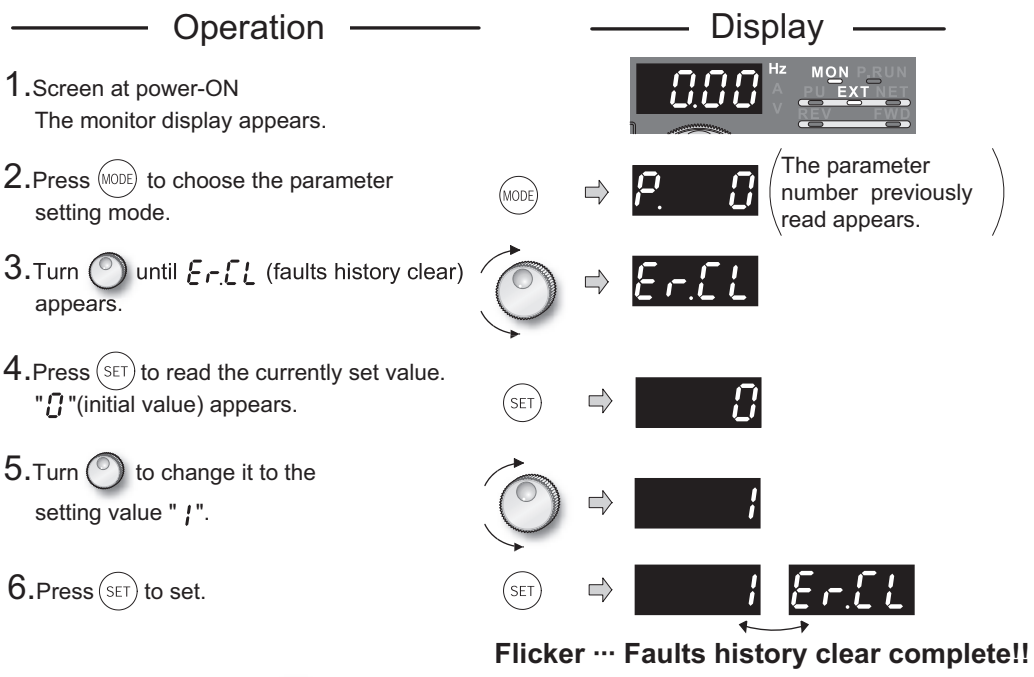


* The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0.
When the operation panel (FR-DU07) is used, the time is displayed up to 65.53 (65530h) in the indication of 1h = 0.001, and thereafter, it is added up from 0.

(2) Clearing procedure

POINT

· The faults history can be cleared by setting "1" in *Er.CL Faults history clear*.



· Press to read another parameter.

· Press SET to show the setting again.

· Press SET twice to show the next parameter.

5.6 Check first when you have a trouble

Refer to troubleshooting on page *81* (speed control) in addition to the following check points.

POINT

- If the cause is still unknown after every check, it is recommended to initialize the parameters (initial value) then reset the required parameter values and check again.
- Refer to the *Instruction Manual (Applied)* for 🕮 in "Refer to page" column.

5.6.1 Motor does not start

Check points	Possible Cause	Countermeasures	Refer to page
Main Circuit	Appropriate power supply voltage is not applied. (Operation panel display is not provided.)	Power ON a moulded case circuit breaker (MCCB), an earth leakage circuit breaker (ELB), or a magnetic contactor (MC).	—
		Check for the decreased input voltage, input phase loss, and wiring.	
		If only the control power is ON when using a separate power source for the control circuit, turn ON the main circuit power.	*19*
	Motor is not connected properly.	Check the wiring between the inverter and the motor. If commercial power supply-inverter switchover function is active, check the wiring of the magnetic contactor connected between the inverter and the motor.	*14*
Input signal	Start signal is not input.	Check the start command source, and input a start signal. PU operation mode: FWD / REV External operation mode : STF/STR signal	*47*
	Both the forward and reverse rotation start signals (STF, STR) are input simultaneously.	Turn ON only one of the forward and reverse rotation start signals (STF or STR). If STF and STR signals are turned ON simultaneously in the initial setting, a stop command is given.	*20*
	Frequency command is zero. (FWD or REV LED on the operation panel is flickering.)	Check the frequency command source and enter a frequency command.	*47*
	AU signal is not ON when terminal 4 is used for frequency setting. (FWD or REV LED on the operation panel is flickering.)	Turn ON the AU signal. Turning ON the AU signal activates terminal 4 input.	*20*
	Output stop signal (MRS) or reset signal (RES) is ON. (FWD or REV LED on the operation panel is flickering.)	Turn MRS or RES signal OFF. Inverter starts the operation with a given start command and a frequency command after turning OFF MRS or RES signal. Before turning OFF, ensure the safety.	*20*
	CS signal is OFF when automatic restart after instantaneous power failure function is selected (*Pr. 57* ≠ "9999"). (FWD or REV LED on the operation panel is flickering.)	Turn ON the CS signal. Restart operation is enabled when restart after instantaneous power signal (CS) is ON.	🕮
	Jumper connector of sink - source is wrongly selected. (FWD or REV LED on the operation panel is flickering.)	Check that the control logic switchover jumper connector is correctly installed. If it is not installed correctly, input signal is not recognized.	*23*
	Wiring of encoder is incorrect. (Under encoder feedback control or vector control)	Check the wiring of encoder.	*31*
	Voltage/current input switch is not correctly set for analog input signal (0 to 5V/0 to 10V, 4 to 20mA). (FWD or REV LED on the operation panel is flickering.)	Set *Pr. 73, Pr. 267*, and a voltage/current input switch correctly, then input an analog signal in accordance with the setting.	*20*

Check points	Possible Cause	Countermeasures	Refer to page
Parameter Setting	STOP RESET was pressed. (Operation panel indication is PS (PS).)	During the External operation mode, check the method of restarting from a STOP RESET input stop from PU.	146
	Two-wire or three-wire type connection is wrong.	Check the connection. Connect STOP signal when three-wire type is used.	125
	Pr. 0 Torque boost setting is improper when V/F control is used.	Increase *Pr. 0* setting by 0.5% increments while observing the rotation of a motor. If that makes no difference, decrease the setting.	59
	Pr. 78 Reverse rotation prevention selection is set.	Check the *Pr. 78* setting. Set *Pr. 78* when you want to limit the motor rotation to only one direction.	114
	Pr. 79 Operation mode selection setting is wrong.	Select the operation mode which corresponds with input methods of start command and frequency command.	47
	Bias and gain *(calibration parameter C2 to C7)* settings are improper.	Check the bias and gain *(calibration parameter C2 to C7)* settings.	119
	Pr. 13 Starting frequency setting is greater than the running frequency.	Set running frequency higher than *Pr. 13*. The inverter does not start if the frequency setting signal is less than the value set in *Pr. 13*.	104
	Frequency settings of various running frequency (such as multi-speed operation) are zero. Especially, *Pr. 1 Maximum frequency* is zero.	Set the frequency command according to the application. Set *Pr. 1* higher than the actual frequency used.	60
	Pr. 15 Jog frequency setting is lower than *Pr. 13 Starting frequency*.	Set *Pr. 15 Jog frequency* higher than *Pr. 13 Starting frequency.*	105
	The *Pr.359 Encoder rotation direction* setting is incorrect under encoder feedback control or under vector control.	If the "REV" on the operation panel is lit even though the forward-rotation command is given, set *Pr. 359* ="1."	33
	Operation mode and a writing device do not match.	Check *Pr. 79, Pr. 338, Pr. 339, Pr. 550, Pr. 551,* and select an operation mode suitable for the purpose.	62, 129
	Start signal operation selection is set by the *Pr. 250 Stop selection*	Check *Pr. 250* setting and connection of STF and STR signals.	125
	Inverter decelerated to a stop when power failure deceleration stop function is selected.	When power is restored, ensure the safety, and turn OFF the start signal once, then turn ON again to restart. Inverter restarts when *Pr. 261*="2, 12".	126
	Auto tuning is being performed.	In the PU operation, press STOP RESET on the operation panel after the offline auto tuning completes. In the External operation, turn OFF the start signal (STF, STR). By this operation, offline auto tuning is cancelled, and the monitor display on the PU goes back to normal. (If this operation is not performed, you cannot proceed to the next operation.)	71
	Automatic restart after instantaneous power failure function or power failure stop function is activated. (Performing overload operation during input phase loss may cause voltage insufficiency, and that may result in detection of power failure.)	• Set *Pr. 872 Input phase loss protection selection* = "1" (input phase failure protection active). • Disable the automatic restart after instantaneous power failure function and power failure stop function. • Reduce the load. • Increase the acceleration time if the automatic restart after instantaneous power failure function or power failure stop function occurred during acceleration.	111, 126
Load	Load is too heavy.	Reduce the load.	—
	Shaft is locked.	Inspect the machine (motor).	—

5.6.2 Motor or machine is making abnormal acoustic noise

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Disturbance due to EMI when frequency command is given from analog input (terminal 1, 2, 4).	Take countermeasures against EMI.	🕮
Parameter Setting		Increase the *Pr. 74 Input filter time constant* if steady operation cannot be performed due to EMI.	*114*
Parameter Setting	No carrier frequency noises (metallic noises) are generated.	In the initial setting, *Pr. 240 Soft-PWM operation selection* is enabled to change motor noise to an unoffending complex tone. Therefore, no carrier frequency noises (metallic noises) are generated. Set *Pr. 240* = "0" to disable this function.	*113*
	Resonance occurs. (output frequency)	Set *Pr. 31 to Pr. 36 (Frequency jump)*. When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped.	*108*
	Resonance occurs. (carrier frequency)	Change *Pr. 72 PWM frequency selection* setting. Changing the PWM carrier frequency produces an effect on avoiding the resonance frequency of a mechanical system or a motor.	*113*
		Set a notch filter.	🕮
	Auto tuning is not performed under Advanced magnetic flux vector control, Real sensorless vector control, or vector control.	Perform offline auto tuning.	*71*
	Gain adjustment during PID control is insufficient.	To stabilize the measured value, change the proportional band (*Pr. 129*) to a larger value, the integral time (*Pr. 130*) to a slightly longer time, and the differential time (*Pr. 134*) to a slightly shorter time. Check the calibration of set point and measured value.	*120*
	The gain is too high under Real sensorless vector control or vector control.	During speed control, check the setting of *Pr. 820* (*Pr. 830*) *speed control P gain*.	*135*
		During torque control, check the setting of *Pr. 824* (*Pr. 834*) *torque control P gain*.	*136*
Others	Mechanical looseness	Adjust machine/equipment so that there is no mechanical looseness.	—
	Contact the motor manufacturer.		
Motor	Operating with output phase loss	Check the motor wiring.	—

5.6.3 Inverter generates abnormal noise

Larger acoustic noise is generated during regenerative driving than during power driving because the inverter contains an AC reactor. This is not a fault.

Connecting a single-phase power supply device or having an unbalanced power supply may cause the reactor to generate acoustic noise even in non-operating status. This is not a fault.

Check points	Possible Cause	Countermeasures	Refer to page
Fan	Fan cover was not correctly installed when a cooling fan was replaced.	Install a fan cover correctly.	*175*

5.6.4 Motor generates heat abnormally

Check points	Possible Cause	Countermeasures	Refer to page
Motor	Motor fan is not working (Dust is accumulated.)	Clean the motor fan. Improve the environment.	—
	Phase to phase insulation of the motor is insufficient.	Check the insulation of the motor.	—
Main Circuit	The inverter output voltage (U, V, W) are unbalanced.	Check the output voltage of the inverter. Check the insulation of the motor.	*171*
Parameter Setting	The *Pr. 71 Applied motor* setting is wrong.	Check the *Pr. 71 Applied motor* setting.	*113*
—	Motor current is large.	Refer to "5.6.8 Motor current is too large"	*166*

5.6.5 Motor rotates in the opposite direction

Check points	Possible Cause	Countermeasures	Refer to page
Main Circuit	Phase sequence of output terminals U, V and W is incorrect.	Connect phase sequence of the output cables (terminal U, V, W) to the motor correctly.	*13*
Input signal	The start signals (forward rotation, reverse rotation) are connected improperly.	Check the wiring. (STF: forward rotation , STR: reverse rotation)	*20*
	The polarity of the frequency command is negative during the polarity reversible operation set by *Pr. 73 Analog input selection*.	Check the polarity of the frequency command.	🕮
Input signal Parameter setting	Torque command is negative during torque control under vector control.	Check the torque command value.	🕮

5.6.6 Speed greatly differs from the setting

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Frequency setting signal is incorrectly input.	Measure the input signal level.	—
	The input signal lines are affected by external EMI.	Take countermeasures against EMI such as using shielded wires for input signal lines.	🕮
Parameter Setting	*Pr. 1, Pr. 2, Pr. 18,calibration parameter C2 to C7* settings are improper.	Check the settings of *Pr. 1 Maximum frequency, Pr. 2 Minimum frequency, Pr. 18 High speed maximum frequency.*	*103*
		Check the *calibration parameter C2 to C7* settings.	*119*
	Pr. 31 to Pr. 36 (frequency jump) settings are improper.	Narrow down the range of frequency jump.	*108*
Load	Stall prevention (torque limit) function is activated due to a heavy load.	Reduce the load weight.	—
Parameter Setting		Set *Pr. 22 Stall prevention operation level (Torque limit level)* higher according to the load. (Setting *Pr. 22* too large may result in frequent overcurrent trip (E.OC□).)	*106* (*107*)
Motor		Check the capacities of the inverter and the motor.	—

5.6.7 Acceleration/deceleration is not smooth

Check points	Possible Cause	Countermeasures	Refer to page
Parameter Setting	Acceleration/deceleration time is too short.	Increase acceleration/deceleration time.	*61*
	Torque boost (*Pr. 0, Pr. 46*, *Pr. 112*) setting is improper under V/F control, so the stall prevention function is activated.	Increase/decrease *Pr. 0 Torque boost* setting value by 0.5% increments to the setting.	*59*
	The base frequency setting and the motor characteristic does not match.	For V/F control, set *Pr. 3 Base frequency*, *Pr. 47 Second V/F (base frequency)*, and *Pr.113 Third V/F (base frequency)*.	*103*
		For vector control, set *Pr.84 Rated motor frequency*.	*71*
	Regeneration avoidance operation is performed	If the frequency becomes unstable during regeneration avoidance operation, decrease the setting of *Pr. 886 Regeneration avoidance voltage gain*.	*138*
Load	Stall prevention (torque limit) function is activated due to a heavy load.	Reduce the load weight.	—
Parameter Setting		Set *Pr. 22 Stall prevention operation level (Torque limit level)* higher according to the load. (Setting *Pr. 22* too large may result in frequent overcurrent trip (E.OC☐).)	*106* (*107*)
Motor		Check the capacities of the inverter and the motor.	—

5.6.8 Motor current is too large

Check points	Possible Cause	Countermeasures	Refer to page
Parameter Setting	Torque boost (*Pr. 0, Pr. 46, Pr. 112*) setting is improper under V/F control, so the stall prevention function is activated.	Increase/decrease *Pr. 0 Torque boost* setting value by 0.5% increments to the setting.	*59*
	V/F pattern is improper when V/F control is performed. (*Pr. 3, Pr. 14, Pr. 19*)	Set rated frequency of the motor to *Pr. 3 Base frequency*. Use *Pr. 19 Base frequency voltage* to set the base voltage (e.g. rated motor voltage).	*103*
		Change *Pr. 14 Load pattern selection* according to the load characteristic.	*105*
	Stall prevention (torque limit) function is activated due to a heavy load.	Reduce the load weight.	—
		Set *Pr. 22 Stall prevention operation level (Torque limit level)* higher according to the load. (Setting *Pr. 22* too large may result in frequent overcurrent trip (E.OC☐).)	*106* (*107*)
		Check the capacities of the inverter and the motor.	—
	Auto tuning is not performed under Advanced magnetic flux vector control, Real sensorless vector control, or vector control.	Perform offline auto tuning.	*71*

5.6.9 Speed does not accelerate

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Start command and frequency command are chattering.	Check if the start command and the frequency command are correct.	—
	The wiring length used for analog frequency command is too long, and it is causing a voltage (current) drop.	Perform analog input bias/gain calibration.	📖
	Input signal lines are affected by external EMI.	Take countermeasures against EMI, such as using shielded wires for input signal lines.	📖
Parameter Setting	*Pr. 1, Pr. 2, Pr. 18, calibration parameter C2 to C7* settings are improper.	Check the settings of *Pr. 1 Maximum frequency and Pr. 2 Minimum frequency*. If you want to run the motor at 120Hz or higher, set *Pr. 18 High speed maximum frequency*.	*103*
		Check the *calibration parameter C2 to C7* settings.	*119*
	Torque boost (*Pr. 0, Pr. 46, Pr. 112*) setting is improper under V/F control, so the stall prevention function is activated.	Increase/decrease *Pr. 0 Torque boost* setting value by 0.5% increments so that stall prevention does not occur.	*59*
	V/F pattern is improper when V/F control is performed. (*Pr. 3, Pr. 14, Pr. 19*)	Set rated frequency of the motor to *Pr. 3 Base frequency.* Use *Pr. 19* Base frequency voltage to set the base voltage (e.g. rated motor voltage).	*103*
		Change *Pr. 14 Load pattern selection* according to the load characteristic.	*105*
	Auto tuning is not performed under Advanced magnetic flux vector control, Real sensorless vector control, or vector control.	Perform offline auto tuning.	*71*
	The setting of pulse train input is improper.	Check the specification of the pulse generator (open collector output or complementary output) and check the adjustment of the pulse train and frequency (*Pr. 385* and *Pr. 386*).	📖
	During PID control, output frequency is automatically controlled to make measured value = set point.		📖
Load	Stall prevention (torque limit) function is activated due to a heavy load.	Reduce the load weight.	—
Parameter Setting		Set *Pr. 22 Stall prevention operation level (Torque limit level)* higher according to the load. (Setting *Pr. 22* too large may result in frequent overcurrent trip (E.OC□).)	*106* (*107*)
Motor		Check the capacities of the inverter and the motor.	—

5.6.10 Motor and machine vibrate

Check points	Possible Cause	Countermeasures	Refer to page
Parameter Setting	*Pr.19 Base frequency voltage* is improper under V/F control.	Set the rated motor voltage to *Pr.19 Base frequency voltage*.	*103*
	Mechanical looseness	Adjust machine/equipment so that there is no mechanical looseness.	—

5.6.11 Speed varies during operation

When Advanced magnetic flux vector control, Real sensorless vector control, vector control or encoder feedback control is exercised, the output frequency varies with load fluctuation between 0 and 2Hz. This is a normal operation and is not a fault.

Check points	Possible Cause	Countermeasures	Refer to page
Load	Load varies during an operation.	Select Advanced magnetic flux vector control, Real sensorless vector control, vector control, or encoder feedback control.	*63*, *66*, 🕮
Input signal	Frequency setting signal is varying.	Check the frequency setting signal.	—
	The frequency setting signal is affected by EMI.	Set filter to the analog input terminal using *Pr. 74 Input filter time constant, Pr. 822 Speed setting filter 1*.	*114*
		Take countermeasures against EMI, such as using shielded wires for input signal lines.	🕮
	Malfunction is occurring due to the undesirable current generated when the transistor output unit is connected.	Use terminal PC (terminal SD when source logic) as a common terminal to prevent a malfunction caused by undesirable current.	*24*
	Multi-speed command signal is chattering.	Take countermeasures to suppress chattering.	—
	Feedback signal from the encoder is affected by EMI.	Place the encoder cable far from the EMI source such as main circuit and power supply voltage. Earth (ground) the shield of the encoder cable to the enclosure using a metal P-clip or U-clip.	*31*
Parameter Setting	*Pr.80 Motor capacity* and *Pr.81 Number of motor poles* are not appropriate for the motor capacity under Advanced magnetic flux vector control, Real sensorless vector control, or vector control.	Check the settings of *Pr.80 Motor capacity* and *Pr.81 Number of motor poles*.	*63*, *66*
	Fluctuation of power supply voltage is too large.	Change the *Pr. 19 Base frequency voltage* setting (about 3%) under V/F control.	*103*
	Wiring length exceeds 30m when Advanced magnetic flux vector control, Real sensorless vector control, or vector control is selected.	Perform offline auto tuning.	*71*
	Wiring length is too long for V/F control, and the a voltage drop occurs.	Adjust the *Pr. 0 Torque boost* setting by increasing with 0.5% increments for the low-speed operation.	*59*
		Change the control method to Advanced magnetic flux vector control or Real sensorless vector control.	*63*
	Hunting occurs by the generated vibration, for example, when structural rigidity at load side is insufficient.	Disable automatic control functions, such as the energy saving operation, the fast-response current limit function, the torque limit, the regeneration avoidance function, Advanced magnetic flux vector control, Real sensorless vector control, vector control, encoder feedback control, droop control, the stall prevention, online auto tuning, the notch filter, and orientation control. During the PID control, set smaller values to *Pr.129 PID proportional band* and *Pr.130 PID integral time*. Lower the control gain, and adjust to increase the stability.	—
		Change *Pr. 72 PWM frequency selection* setting.	*113*

5.6.12 Operation mode is not changed properly

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Start signal (STF or STR) is ON.	Check that the STF and STR signals are OFF. When either is ON, the operation mode cannot be changed.	62
Parameter Setting	*Pr. 79* setting is improper.	When *Pr. 79 Operation mode selection* setting is "0" (initial value), the inverter is placed in the External operation mode at input power ON. To switch to the PU operation mode, press PU/EXT on the operation panel (press PU when the parameter unit (FR-PU04/FR-PU07) is used) . At other settings (1 to 4, 6, 7), the operation mode is limited accordingly.	62
	Operation mode and a writing device do not correspond.	Check *Pr. 79, Pr. 338, Pr. 339, Pr. 550, Pr. 551,* and select an operation mode suitable for the purpose.	62, 129

5.6.13 Operation panel (FR-DU07) display is not operating

Check points	Possible Cause	Countermeasures	Refer to page
Main Circuit, Control Circuit	Power is not input.	Input the power.	12
Front cover	Operation panel is not properly connected to the inverter.	Check if the inverter front cover is installed securely. The inverter cover may not fit properly when using wires whose size are 1.25mm^2 or larger, or when using many wires, and this could cause a contact fault of the operation panel.	4

5.6.14 Power lamp is not lit

Check points	Possible Cause	Countermeasures	Refer to page
Main Circuit, Control Circuit	Wiring or installation is improper.	Check for the wiring and the installation. Power lamp is lit when power is input to the control circuit (R1/L11, S1/L21).	13

5.6.15 Unable to write parameter setting

Check points	Possible Cause	Countermeasures	Refer to page
Input signal	Operation is being performed (signal STF or STR is ON).	Stop the operation. When *Pr. 77* = "0" (initial value), write is enabled only during a stop.	114
Parameter Setting	You are attempting to set the parameter in the External operation mode.	Choose the PU operation mode. Or, set *Pr. 77* = "2" to enable parameter write regardless of the operation mode.	114
	Parameter is disabled by the *Pr. 77 Parameter write selection* setting.	Check *Pr. 77 Parameter write selection* setting.	114
	Key lock is activated by the *Pr. 161 Frequency setting/ key lock operation selection* setting.	Check *Pr. 161 Frequency setting/key lock operation selection* setting.	122
	Operation mode and a writing device do not correspond.	Check *Pr. 79, Pr. 338, Pr. 339, Pr. 550, Pr. 551,* and select an operation mode suitable for the purpose.	62, 129

6 PRECAUTIONS FOR MAINTENANCE AND INSPECTION

The inverter is a static unit mainly consisting of semiconductor devices. Daily inspection must be performed to prevent any fault from occurring due to the adverse effects of the operating environment, such as temperature, humidity, dust, dirt and vibration, changes in the parts with time, service life, and other factors.

• Precautions for maintenance and inspection

For some short time after the power is switched off, a high voltage remains in the smoothing capacitor. When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched off, and then make sure that the voltage across the main circuit terminals P/+-N/– of the inverter is not more than 30VDC using a tester, etc.

6.1 Inspection item

6.1.1 Daily inspection

Basically, check for the following faults during operation.
(1) Motor operation fault
(2) Improper installation environment
(3) Cooling system fault
(4) Unusual vibration and noise
(5) Unusual overheat and discoloration

6.1.2 Periodic inspection

Check the areas inaccessible during operation and requiring periodic inspection.
Consult us for periodic inspection.
1) Check for cooling system fault.....Clean the air filter, etc.
2) Tightening check and retightening.....The screws and bolts may become loose due to vibration, temperature changes, etc.
Tighten them according to the specified tightening torque. *(Refer to page 16)*
3) Check the conductors and insulating materials for corrosion and damage.
4) Measure insulation resistance.
5) Check and change the cooling fan and relay.

6.1.3 Daily and periodic inspection

Area of Inspection	Inspection Item	Description	Interval		Corrective Action at Alarm Occurrence	Customer's Check
			Daily	Periodic *2		
General	Surrounding environment	Check the surrounding air temperature, humidity, dirt, corrosive gas, oil mist , etc.	○		Improve environment	
	Overall unit	Check for unusual vibration and noise.	○		Check alarm location and retighten	
	Power supply voltage	Check that the main circuit voltages and control voltages are normal.*1	○		Inspect the power supply	
Main circuit	General	(1) Check with megger (across main circuit terminals and earth (ground) terminal).		○	Contact the manufacturer	
		(2) Check for loose screws and bolts.		○	Retighten	
		(3) Check for overheat traces on the parts.		○	Contact the manufacturer	
		(4) Check for stain.		○	Clean	
	Conductors, cables	(1) Check conductors for distortion.		○	Contact the manufacturer	
		(2) Check cable sheaths for breakage and deterioration (crack, discoloration, etc.).		○	Contact the manufacturer	
	Transformer/reactor	Check for unusual odor and abnormal increase in whining sound.	○		Stop the device and contact the manufacturer.	
	Terminal block	Check for damage.		○	Stop the device and contact the manufacturer.	
	Smoothing aluminum electrolytic capacitor	(1) Check for liquid leakage.		○	Contact the manufacturer	
		(2) Check for safety valve projection and bulge.		○	Contact the manufacturer	
		(3) Visual check and judge by the life check of the main circuit capacitor. *(Refer to page 172)*		○		
	Relay/contactor	Check that the operation is normal and no chatter is heard.		○	Contact the manufacturer	
	Resistor	(1) Check for crack in resistor insulation.		○	Contact the manufacturer	
		(2) Check for a break in the cable.		○	Contact the manufacturer	
Control circuit protective circuit	Operation check	(1) Check that the output voltages across phases with the inverter operated alone is balanced.		○	Contact the manufacturer	
		(2) Check that no fault is found in protective and display circuits in a sequence protective operation test.		○	Contact the manufacturer	
	Parts check: Overall	(1) Check for unusual odor and discoloration.		○	Stop the device and contact the manufacturer.	
		(2) Check for serious rust development.		○	Contact the manufacturer	
	Parts check: Aluminum electrolytic capacitor	(1) Check for liquid leakage in a capacitor and deformation trace.		○	Contact the manufacturer	
		(2) Visual check and judge by the life check of the control circuit capacitor. *(Refer to page 172.)*		○		
Cooling system	Cooling fan	(1) Check for unusual vibration and noise.	○		Replace the fan	
		(2) Check for loose screws and bolts.		○	Fix with the fan cover fixing screws	
		(3) Check for stain.		○	Clean	
	Heatsink	(1) Check for clogging.		○	Clean	
		(2) Check for stain.		○	Clean	
	Air filter, etc.	(1) Check for clogging.		○	Clean or replace	
		(2) Check for stain.		○	Clean or replace	
Display	Indication	(1) Check that display is normal.	○		Contact the manufacturer	
		(2) Check for stain.		○	Clean	
	Meter	Check that reading is normal.	○		Stop the device and contact the manufacturer.	
Load motor	Operation check	Check for vibration and abnormal increase in operation noise.	○		Stop the device and contact the manufacturer.	

*1 It is recommended to install a device to monitor voltage for checking the power supply voltage to the inverter.

*2 One to two years of periodic inspection cycle is recommended. However, it differs according to the installation environment. Consult us for periodic inspection.

6.1.4 Display of the life of the inverter parts

The self-diagnostic alarm is output when the lifespan of the control circuit capacitor, cooling fan, each parts of the inrush current limit circuit is near its end. It gives an indication of replacement time .

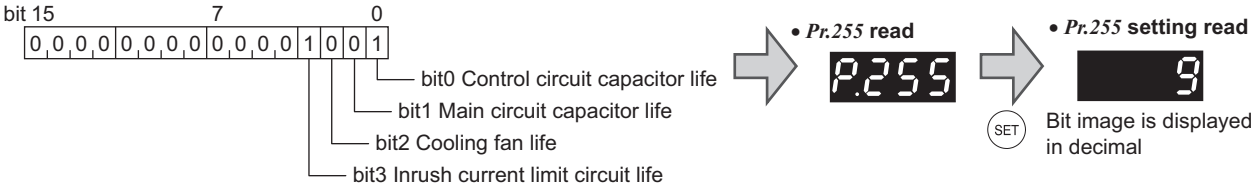
The life alarm output can be used as a guideline for life judgement.

Parts	Judgement Level
Main circuit capacitor	85% of the initial capacity
Control circuit capacitor	Estimated 10% life remaining
Inrush current limit circuit	Estimated 10% life remaining (Power on: 100,000 times left)
Cooling fan	Less than 50% of the predetermined speed

For the life check of the main circuit capacitor, the alarm signal (Y90) will not be output if a measuring method of (2) is not performed. *(Refer to page 173.)*

(1) Display of the life alarm

· *Pr. 255 Life alarm status display* can be used to confirm that the control circuit capacitor, main circuit capacitor, cooling fan, and each parts of the inrush current limit circuit has reached the life alarm output level.



Pr. 255 (decimal)	Bit (binary)	Inrush Current Limit Circuit Life	Cooling Fan Life	Main Circuit Capacitor Life	Control Circuit Capacitor Life
15	1111	○	○	○	○
14	1110	○	○	○	×
13	1101	○	○	×	○
12	1100	○	○	×	×
11	1011	○	×	○	○
10	1010	○	×	○	×
9	1001	○	×	×	○
8	1000	○	×	×	×
7	0111	×	○	○	○
6	0110	×	○	○	×
5	0101	×	○	×	○
4	0100	×	○	×	×
3	0011	×	×	○	○
2	0010	×	×	○	×
1	0001	×	×	×	○
0	0000	×	×	×	×

○: with alarm, ×: without alarm

POINT

Life check of the main circuit capacitor needs to be done by *Pr. 259*. (Refer to the following.)

(2) Measuring method of life of the main circuit capacitor

- If the value of capacitor capacity measured before shipment is considered as 100%, *Pr. 255* bit1 is turned ON when the measured value falls below 85%.
- Measure the capacitor capacity according to the following procedure and check the deterioration level of the capacitor capacity.
  1) Check that the motor is connected and at a stop.
  2) Set "1" (measuring start) in *Pr. 259*
  3) Switch power off. The inverter applies DC voltage to the motor to measure the capacitor capacity while the inverter is off.
  4) After confirming that the LED of the operation panel is off, power on again.
  5) Check that "3" (measuring completion) is set in *Pr. 259*, then read *Pr .258* and check the life of the main circuit capacitor.

REMARKS

- When the main circuit capacitor life is measured under the following conditions, "forced end" (*Pr. 259* = "8") or "measuring error" (*Pr. 259* = "9") occurs or it remains in "measuring start" (*Pr. 259* = "1"). When measuring, avoid the following conditions to perform. In addition, even when "measurement completion" (*Pr. 259* = "3") is confirmed under the following conditions, normal measurement can not be done.
  (a)Terminal R1/L11, S1/L21 is connected to the terminals P/+ and N/–.
  (b)Switch power on during measuring.
  (c)The motor is not connected to the inverter.
  (d)The motor is running.(The motor is coasting.)
  (e)The motor capacity is two rank smaller as compared to the inverter capacity.
  (f)The inverter is at an alarm stop or an alarm occurred while power is off.
  (g)The inverter output is shut off with the MRS signal.
  (h)The start command is given while measuring.
- Operating environment: Surrounding air temperature (annual average 40°C (free from corrosive gas, flammable gas, oil mist, dust and dirt))
  Output current (80% of the inverter rated current)

POINT

For accurate life measurement of the main circuit capacitor, wait 3 hours or longer after turning OFF. The temperature left in the main circuit capacitor affects measurement.

⚠ WARNING

⚠ When measuring the main circuit capacitor capacity (*Pr. 259 Main circuit capacitor life measuring* = "1"), the DC voltage is applied to the motor for 1s at powering off. Never touch the motor terminal, etc. right after powering off to prevent an electric shock.

6.1.5 Checking the inverter and converter modules

<Preparation>

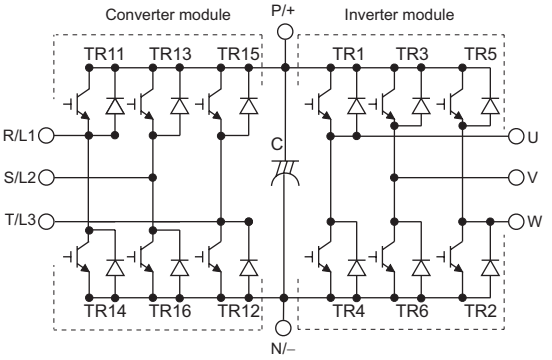
(1) Disconnect the external power supply cables (R/L1, S/L2, T/L3) and motor cables (U, V, W).
(2) Prepare a tester. (Use 100Ω range.)

<Checking method>

Change the polarity of the tester alternately at the inverter terminals R/L1, S/L2, T/L3, U, V, W, P/+ and N/–, and check for electric continuity.

<Module device numbers and terminals to be checked>

		Tester Polarity		Measured Value		Tester Polarity		Measured Value
		⊕	⊖			⊕	⊖	
Converter module	TR11	R/L1	P/+	Discontinuity	TR14	R/L1	N/–	Continuity
		P/+	R/L1	Continuity		N/–	R/L1	Discontinuity
	TR13	S/L2	P/+	Discontinuity	TR16	S/L2	N/–	Continuity
		P/+	S/L2	Continuity		N/–	S/L2	Discontinuity
	TR15	T/L3	P/+	Discontinuity	TR12	T/L3	N/–	Continuity
		P/+	T/L3	Continuity		N/–	T/L3	Discontinuity
Inverter module	TR1	U	P/+	Discontinuity	TR4	U	N/–	Continuity
		P/+	U	Continuity		N/–	U	Discontinuity
	TR3	V	P/+	Discontinuity	TR6	V	N/–	Continuity
		P/+	V	Continuity		N/–	V	Discontinuity
	TR5	W	P/+	Discontinuity	TR2	W	N/–	Continuity
		P/+	W	Continuity		N/–	W	Discontinuity



(Assumes the use of an analog meter.)

6.1.6 Cleaning

Always run the inverter in a clean status.
When cleaning the inverter, gently wipe dirty areas with a soft cloth immersed in neutral detergent or ethanol.

CAUTION

Do not use solvent, such as acetone, benzene, toluene and alcohol, as they will cause the inverter surface paint to peel off.
The display, etc. of the operation panel (FR-DU07) and parameter unit (FR-PU04/FR-PU07) are vulnerable to detergent and alcohol. Therefore, avoid using them for cleaning.

6.1.7 Replacement of parts

The inverter consists of many electronic parts such as semiconductor devices.
The following parts may deteriorate with age because of their structures or physical characteristics, leading to reduced performance or fault of the inverter. For preventive maintenance, the parts must be replaced periodically.
Use the life check function as a guidance of parts replacement.

Part Name	Estimated lifespan *1	Description
Cooling fan	10 years	Replace (as required)
Main circuit smoothing capacitor	10 years *2	Replace (as required)
On-board smoothing capacitor	10 years	Replace the board (as required)
Relays	–	as required

*1 Estimated lifespan for when the yearly average surrounding air temperature is 40°C (without corrosive gas, flammable gas, oil mist, dust and dirt etc)
*2 Output current : 80% of the inverter rated current

REMARKS

- Since repeated inrush currents at power ON will shorten the life of the converter circuit, frequent starts and stops of the magnetic contactor must be avoided.

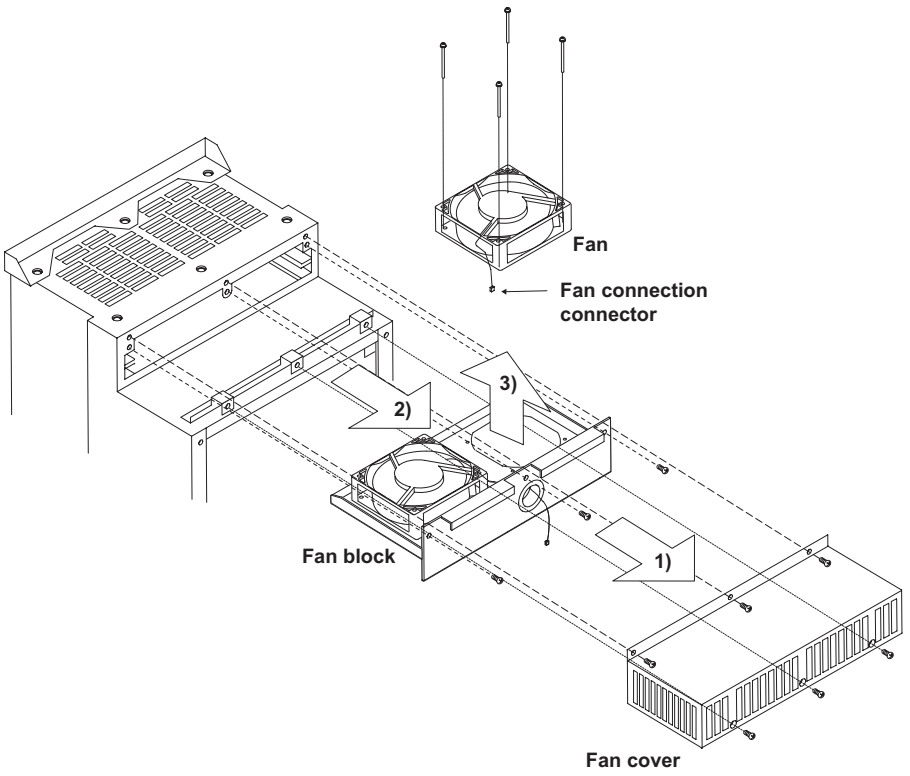
CAUTION

For parts replacement, consult the nearest Mitsubishi FA Center.

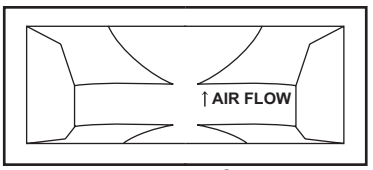
(1) Cooling fan

The replacement interval of the cooling fan used for cooling the parts generating heat such as the main circuit semiconductor is greatly affected by the surrounding air temperature. When unusual noise and/or vibration is noticed during inspection, the cooling fan must be replaced immediately.

• Removal
1) Remove a fan cover.
2) After removing a fan connector, remove a fan block.
3) Remove the fan.



• Reinstallation
1) After confirming the orientation of the fan, reinstall the fan so that the arrow on the left of "AIR FLOW" faces up.



<Fan side face>

2) Install fans referring to the above figure.

CAUTION

- Installing the fan in the opposite of air flow direction can cause the inverter life to be shorter.
- Prevent the cable from being caught when installing a fan.
- Switch the power off before replacing fans. Since the inverter circuits are charged with voltage even after power off, replace fans only when the inverter cover is on the inverter to prevent an electric shock accident.

(2) Smoothing capacitors

A large-capacity aluminum electrolytic capacitor is used for smoothing in the main circuit DC section, and an aluminum electrolytic capacitor is used for stabilizing the control power in the control circuit. Their characteristics are deteriorated by the adverse effects of ripple currents, etc.
The replacement intervals greatly vary with the surrounding air temperature and operating conditions. When the inverter is operated in air-conditioned, normal environment conditions, replace the capacitors about every 10 years.
The appearance criteria for inspection are as follows:

1) Case: Check the side and bottom faces for expansion
2) Sealing plate: Check for remarkable warp and extreme crack.
3) Check for external crack, discoloration, fluid leakage, etc. Judge that the capacitor has reached its life when the measured capacitance of the capacitor reduced below 80% of the rating.

Refer to page 174 to perform the life check of the main circuit capacitor.

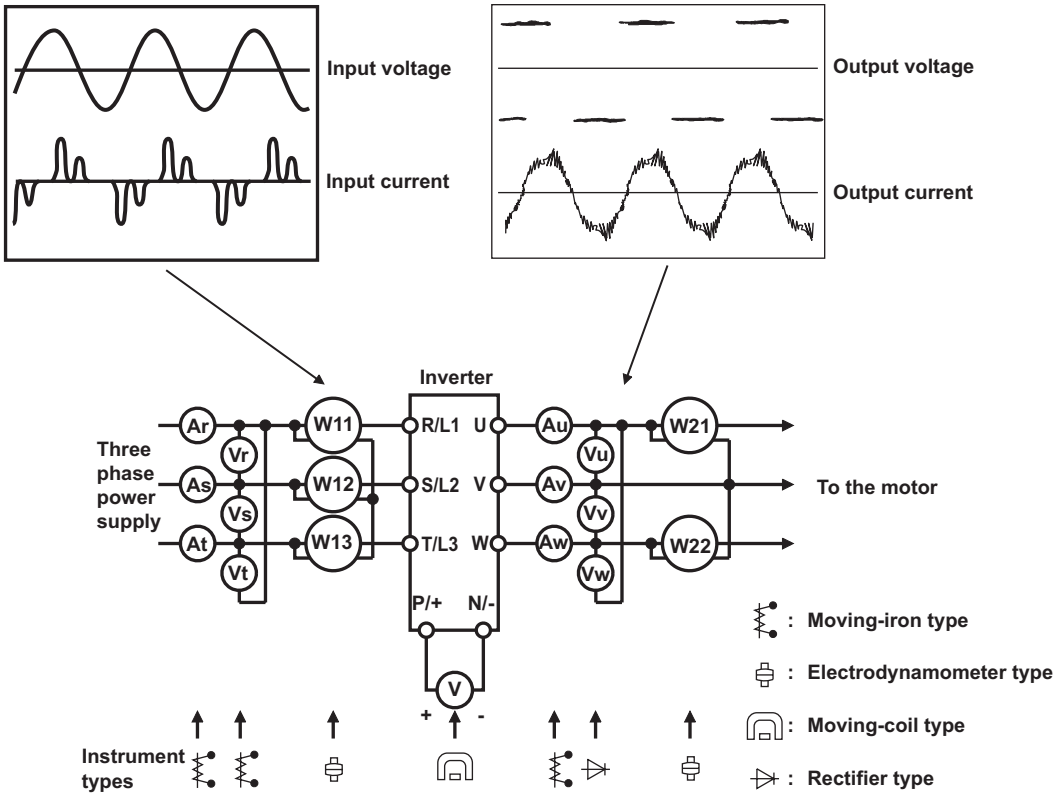
(3) Relays

To prevent a contact fault, etc., relays must be replaced according to the cumulative number of switching times (switching life).

6.2 Measurement of main circuit voltages, currents and powers

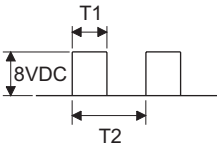
Since the voltages and currents on the inverter power supply and output sides include harmonics, measurement data depends on the instruments used and circuits measured.
When instruments for commercial frequency are used for measurement, measure the following circuits with the instruments given on the next page.

- When installing meters etc. on the inverter output side
  When the inverter-to-motor wiring length is large, especially in the 400V class, small-capacity models, the meters and CTs may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.
  When measuring and indicating the output voltage and output current of the inverter, it is recommended to utilize the terminals AM and FM output function of the inverter.



Examples of Measuring Points and Instruments

Measuring points and instruments

Item	Measuring Point	Measuring Instrument	Remarks (Reference Measured Value)	
Power supply voltage V_1	Across R/L1 and S/L2, S/L2 and T/L3, T/L3 and R/L1	Moving-iron type AC voltmeter *4	Commercial power supply Within permissible AC voltage fluctuation (Refer to *page 182*)	
Power supply side current I_1	R/L1, S/L2, and T/L3 line currents	Moving-iron type AC ammeter *4		
Power supply side power P_1	R/L1, S/L2, T/L3 and R/L1 and S/L2, S/L2 and T/L3, T/L3 and R/L1	Digital power meter (designed for inverter) or electrodynamic type single-phase wattmeter	$P_1 = W_{11} + W_{12} + W_{13}$ (3-wattmeter method)	
Power supply side power factor Pf_1	Calculate after measuring power supply voltage, power supply side current and power supply side power. $Pf_1 = \frac{P_1}{\sqrt{3} V_1 \times I_1} \times 100\%$			
Output side voltage V_2	Across U and V, V and W and W and U	Rectifier type AC voltage meter *1 *4 (Moving-iron type cannot measure)	Difference between the phases is within ±1% of the maximum output voltage.	
Output side current I_2	U, V and W line currents	Moving-iron type AC ammeter *2 *4	Difference between the phases is 10% or lower of the rated inverter current.	
Output side power P_2	U, V, W and U and V, V and W	Digital power meter (designed for inverter) or electrodynamic type single-phase wattmeter	$P_2 = W_{21} + W_{22}$ 2-wattmeter method (or 3-wattmeter method)	
Output side power factor Pf_2	Calculate in similar manner to power supply side power factor. $Pf_2 = \frac{P_2}{\sqrt{3} V_2 \times I_2} \times 100\%$			
Converter output	Across P/+ and N/−	Moving-coil type (such as tester)	Inverter LED display is lit. 1.35 × V1	
Frequency setting signal	Across 2 and 5 Across 4(+) and 5	Moving-coil type (Tester and such may be used) (Internal resistance: 50kΩ or larger)	0 to 10VDC, 4 to 20mA	"5" is common
	Across 1(+) and 5		0 to ±5VDC, 0 to ±10VDC	
Frequency setting power supply	Across 10 (+) and 5		5.2VDC	
	Across 10E(+) and 5		10VDC	
Frequency meter signal	Across AM(+) and 5		Approximately 10VDC at maximum frequency (without frequency meter)	
	Across FM(+) and SD		Approximately 5VDC at maximum frequency (without frequency meter)  Pulse width T1: Adjusted by *C0 (Pr. 900)* Pulse cycle T2: Set by *Pr. 55* (Valid for frequency monitoring only)	"SD" is common
Start signal Select signal	Across SD and the following: STF, STR, RH, RM, RL, JOG, RT, AU, STOP, CS (+)		When open 20 to 30VDC ON voltage: 1V or less	
Reset	Across RES (+) and SD			
Output stop	Across MRS (+) and SD			
Alarm signal	Across A1 and C1 Across B1 and C1	Moving-coil type (such as tester)	Electric continuity check*3 <Normal> <Abnormal> Across A1-C1 Discontinuity Continuity Across B1-C1 Continuity Discontinuity	

*1 Use an FFT to measure the output voltage accurately. A tester or general measuring instrument cannot measure accurately.

*2 When the carrier frequency exceeds 5kHz, do not use this instrument since using it may increase eddy-current losses produced in metal parts inside the instrument, leading to burnout. If the wiring length between the inverter and motor is long, the instrument and CT may generate heat due to line-to-line leakage current.

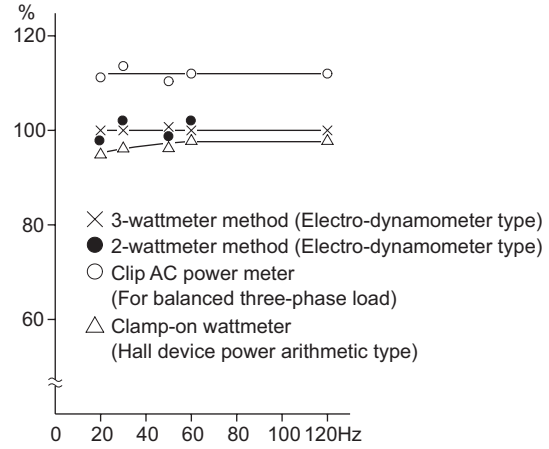
*3 When the setting of *Pr. 195 ABC1 terminal function selection* is positive logic

*4 A digital power meter (designed for inverter) can also be used to measure.

6.2.1 Measurement of powers

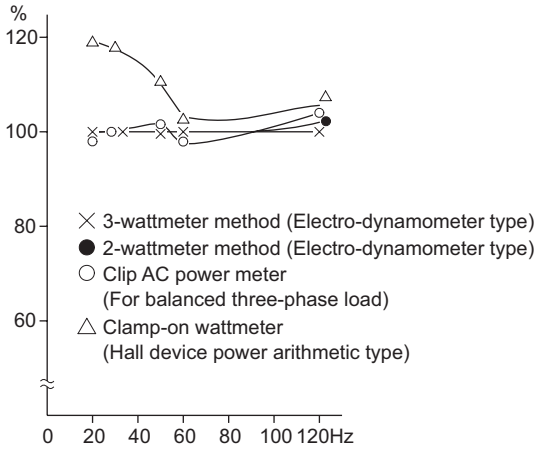
Use digital power meters (for inverter) for the both of inverter input and output side. Alternatively, measure using electrodynamic type single-phase wattmeters for the both of inverter input and output side in two-wattmeter or three- wattmeter method. As the current is liable to be imbalanced especially in the input side, it is recommended to use the three-wattmeter method.
Examples of measured value differences produced by different measuring meters are shown below.
An error will be produced by difference between measuring instruments, e.g. power calculation type and two- or three-wattmeter type three-phase wattmeter. When a CT is used in the current measuring side or when the meter contains a PT on the voltage measurement side, an error will also be produced due to the frequency characteristics of the CT and PT.

[Measurement conditions]
Constant-torque (100%) load, constant-power at 60Hz or more.
3.7kW, 4-pole motor, value indicated in 3-wattmeter method is 100%.



Example of measuring inverter input power

[Measurement conditions]
Constant-torque (100%) load, constant-power at 60Hz or more.
3.7kW, 4-pole motor, value indicated in 3-wattmeter method is 100%.



Example of measuring inverter output power

6.2.2 Measurement of voltages and use of PT

(1) Inverter input side

As the input side voltage has a sine wave and it is extremely small in distortion, accurate measurement can be made with an ordinary AC meter.

(2) Inverter output side

Since the output side voltage has a PWM-controlled rectangular wave, always use a rectifier type voltmeter. A needle type tester can not be used to measure the output side voltage as it indicates a value much greater than the actual value. A moving-iron type meter indicates an effective value which includes harmonics and therefore the value is larger than that of the fundamental wave. The value monitored on the operation panel is the inverter controlled voltage itself. Hence, that value is accurate and it is recommended to monitor values (provide analog output) using the operation panel.

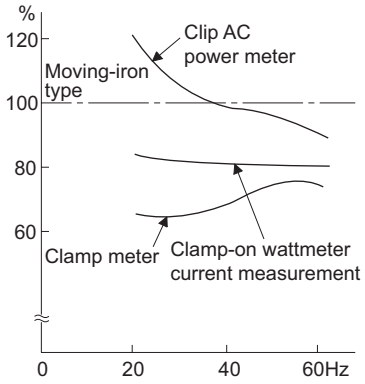
(3) PT

No PT can be used in the output side of the inverter. Use a direct-reading meter. (A PT can be used in the input side of the inverter.)

6.2.3 Measurement of currents

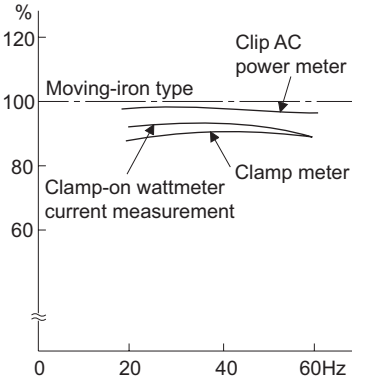
Use a moving-iron type meter on both the input and output sides of the inverter. However, if the carrier frequency exceeds 5kHz, do not use that meter since an overcurrent losses produced in the internal metal parts of the meter will increase and the meter may burn out. In this case, use an approximate-effective value type.
As the inverter input side current is easily imbalanced, measurement of currents in all three phases is recommended. Correct values can not be measured in one or two phases. On the other hand, the phase imbalanced ratio of the output side current must be within 10%.
When using a clamp ammeter, always use an effective value detection type. A mean value detection type produces a large error and may indicate an extremely smaller value than the actual value. The value monitored on the operation panel is accurate if the output frequency varies, and it is recommended to monitor values (provide analog output) using the operation panel.
An example of the measured value difference produced by different measuring meters is shown below.

[Measurement conditions]
Value indicated by moving-iron type ammeter is 100%.



Example of measuring inverter input current

[Measurement conditions]
Value indicated by moving-iron type ammeter is 100%.



Example of measuring inverter output current

6.2.4 Use of CT and transducer

A CT may be used in both the input and output sides of the inverter, but the one used should have the largest possible VA ability because an error will increase if the frequency gets lower.
When using a transducer, use the effective value calculation type which is immune to harmonics.

6.2.5 Measurement of inverter input power factor

Use the effective power and apparent power to calculate the inverter input power factor. A power-factor meter can not indicate an exact value.

$$\text{Total power factor of the inverter} = \frac{\text{Effective power}}{\text{Apparent power}}$$

$$= \frac{\text{Three-phase input power found by 3-wattmeter method}}{\sqrt{3} \times \text{V (power supply voltage)} \times \text{I (input current effective value)}}$$

6.2.6 Measurement of converter output voltage (across terminals P/+ and N/-)

The output voltage of the converter is developed across terminals P/+ - N/- and can be measured with a moving-coil type meter (tester). Although the voltage varies according to the power supply voltage, approximately 270V to 300V (approximately 540V to 600V for the 400V class) is output when no load is connected and voltage decreases when a load is connected.
When energy is regenerated from the motor during deceleration, for example, the converter output voltage rises to nearly 400VDC to 450VDC (800VDC to 900VDC for the 400V class) maximum.

6.2.7 Measurement of inverter output frequency

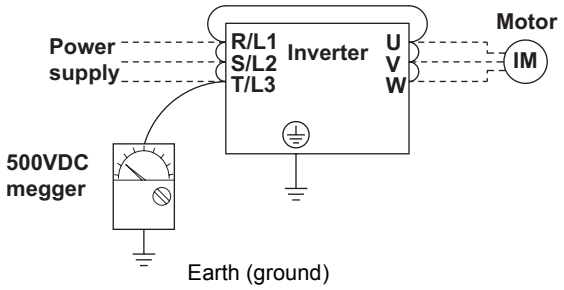
A pulse train proportional to the output frequency is output across the frequency meter signal output terminal FM-SD of the inverter. This pulse train output can be counted by a frequency counter, or a meter (moving-coil type voltmeter) can be used to read the mean value of the pulse train output voltage. When a meter is used to measure the output frequency, approximately 5VDC is indicated at the maximum frequency.
For detailed specifications of the frequency meter signal output terminal FM, refer to *page 22*.

6.2.8 Insulation resistance test using megger

For the inverter, conduct the insulation resistance test on the main circuit only as shown below and do not perform the test on the control circuit. (Use a 500VDC megger.)

CAUTION

- Before performing the insulation resistance test on the external circuit, disconnect the cables from all terminals of the inverter so that the test voltage is not applied to the inverter.
- For the electric continuity test of the control circuit, use a tester (high resistance range) and do not use the megger or buzzer.



6.2.9 Pressure test

Do not conduct a pressure test. Deterioration may occur.

7 SPECIFICATIONS

7.1 Rating

7.1.1 Inverter rating

●200V class

Model FR-A721-□□K		5.5	7.5	11	15	18.5	22	30	37	45	55
Applicable motor capacity (kW) *1		5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2	9.2	12.6	17.6	23.3	29	34	44	55	67	82
	Rated current (A)	24	33	46	61	76	90	115	145	175	215
	Overload current rating *3	150% 60s, 200% 3s (inverse-time characteristics) surrounding air temperature 50°C									
	Rated voltage *4	Three-phase 200 to 240V									
	Regenerative braking torque	100% continuous 150% 60s									
Power supply	Rated input AC voltage/frequency	Three-phase 200 to 220V 50Hz, 200 to 240V 60Hz									
	Permissible AC voltage fluctuation	170 to 242V 50Hz,170 to 264V 60Hz									
	Permissible frequency fluctuation	±5%									
	Power supply capacity (kVA) *5	12	17	20	28	34	41	52	66	80	100
Protective structure (JEM 1030) *6		Open type (IP00)									
Cooling system		Forced air cooling									
Approx. mass (kg)		20	22	33	35	50	52	69	87	90	120

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
*2 The rated output capacity indicated assumes that the output voltage is 220V.
*3 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
*5 The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
*6 FR-DU07:IP40 (except for the PU connector)

●400V class

Model FR-A741-□□K		5.5	7.5	11	15	18.5	22	30	37	45	55
Applicable motor capacity (kW) *1		5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) *2	9.1	13	17.5	23.6	29	32.8	43.4	54	65	84
	Rated current (A)	12	17	23	31	38	44	57	71	86	110
	Overload current rating *3	150% 60s, 200% 3s (inverse-time characteristics) surrounding air temperature 50°C									
	Rated voltage *4	Three-phase 380 to 480V									
	Regenerative braking torque	100% continuous 150% 60s									
Power supply	Rated input AC voltage/frequency	Three-phase 380 to 480V 50Hz/60Hz									
	Permissible AC voltage fluctuation	323 to 528V 50Hz/60Hz									
	Permissible frequency fluctuation	±5%									
	Power supply capacity (kVA) *5	12	17	20	28	34	41	52	66	80	100
Protective structure *6		Open type (IP00)									
Cooling system		Forced air cooling									
Approx. mass (kg)		25	26	37	40	48	49	65	80	83	115

*1 The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.
*2 The rated output capacity indicated assumes that the output voltage is 440V.
*3 The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.
*4 The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.
*5 The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).
*6 FR-DU07:IP40 (except for the PU connector)

7.1.2 Motor rating

(1) SF-V5RU

●200V class (Mitsubishi dedicated motor [SF-V5RU (1500r/min series)])

Motor model SF-V5RU□□K		3	5	7	11	15	18	22	30	37	45
Applicable inverter model FR-A721-□□K		5.5	7.5	11	15	18.5	22	30	37	45	55
Rated output (kW)		3.7	5.5	7.5	11	15	18.5	22	30 *1	37 *1	45 *1
Rated torque (N•m)		23.6	35.0	47.7	70.0	95.5	118	140	191	235	286
Maximum torque 150% 60s (N•m)		35.4	52.4	71.6	105	143	176	211	287	353	429
Rated speed (r/min)		1500									
Maximum speed (r/min)		3000									
Frame No.		112M	132S	132M	160M	160L	180M	180M	200L	200L	200L
Inertia moment J ($\times 10^{-4}$kg•m^2)		175	275	400	750	875	1725	1875	3250	3625	3625
Noise *4		75dB or less							80dB or less		
Cooling fan (with thermal protector) *5	Voltage	Single-phase 200V/50Hz Single-phase 200V to 230V/60Hz			Three-phase 200V/50Hz Three-phase 200 to 230V/60Hz						
	Input *2	36/55W (0.26/ 0.32A)	22/28W (0.11/0.13A)		55/71W (0.37/0.39A)				100/156W (0.47/0.53A)		
Surrounding air temperature, humidity		-10 to +40°C (non-freezing), 90%RH or less (non-condensing)									
Structure (Protective structure)		Totally enclosed forced draft system (Motor: IP44, cooling fan: IP23S) *3									
Detector		Encoder 2048P/R, A phase, B phase, Z phase +12VDC power supply									
Equipment		Encoder, thermal protector, fan									
Heat resistance class		F									
Vibration rank		V10									
Approx. mass (kg)		41	52	62	99	113	138	160	238	255	255

●400V class (Mitsubishi dedicated motor [SF-V5RUH (1500r/min series)])

Motor model SF-V5RUH□□K		5	7	11	15	18	22	30	37	45
Applicable inverter model FR-A741-□□K		7.5	11	15	18.5	22	30	37	45	55
Rated output (kW)		5.5	7.5	11	15	18.5	22	30 *1	37 *1	45 *1
Rated torque (N•m)		35.0	47.7	70.0	95.5	118	140	191	235	286
Maximum torque 150% 60s (N•m)		52.4	71.6	105	143	176	211	287	353	429
Rated speed (r/min)		1500								
Maximum speed (r/min)		3000								
Frame No.		132S	132M	160M	160L	180M	180M	200L	200L	200L
Inertia moment J ($\times 10^{-4}$kg•m^2)		275	400	750	875	1725	1875	3250	3625	3625
Noise *4		75dB or less						80dB or less		
Cooling fan (with thermal protector) *5	Voltage	Single-phase 200V/50Hz Single-phase 200V to 230V/ 60Hz		Three-phase 380 to 400V/50Hz Three-phase 400 to 460V/60Hz						
	Input *1	22/28W (0.11/0.13A)		55/71W (0.19/0.19A)				100/156W (0.27/0.30A)		
Surrounding air temperature, humidity		-10 to +40°C (non-freezing), 90%RH or less (non-condensing)								
Structure (Protective structure)		Totally enclosed forced draft system (Motor: IP44, cooling fan: IP23S) *3								
Detector		Encoder 2048P/R, A phase, B phase, Z phase +12VDC power supply								
Equipment		Encoder, thermal protector, fan								
Heat resistance class		F								
Vibration rank		V10								
Approx. mass (kg)		52	62	99	113	138	160	238	255	255

*1 80% output in the high-speed range. (The output is reduced when the speed is 2400r/min or more. Contact us separately for details.)

*2 Power (current) at 50Hz/60Hz.

*3 Since a motor with brake has a window for gap check, the protective structure of both the cooling fan section and brake section is IP20. S of IP23S is an additional code indicating the condition that protection from water intrusion is established only when a cooling fan is not operating.

*4 The value when high carrier frequency is set (*Pr.72* = 6, *Pr.240* = 0).

*5 The cooling fan is equipped with a thermal protector. The cooling fan stops when the coil temperature exceeds the specified value in order to protect the fan motor. The cooling fan re-starts when the coil temperature drops to normal.

7.2 Common specifications

Control specifications	Control method		Soft-PWM control/high carrier frequency PWM control (V/F control, Advanced magnetic flux vector control and Real sensorless vector control are available) / vector control *1
	Output frequency range		0.2 to 400Hz (The maximum frequency is 120Hz under Real sensorless vector control and vector control.)
	Frequency setting resolution	Analog input	0.015Hz/60Hz (terminal 2, 4: 0 to 10V/12bit) 0.03Hz/60Hz (terminal 2, 4: 0 to 5V/11bit, 0 to 20mA/about 11bit, terminal 1: 0 to ±10V/12bit) 0.06Hz/60Hz (terminal 1: 0 to ±5V/11bit)
		Digital input	0.01Hz
	Frequency accuracy	Analog input	Within ±0.2% of the max. output frequency (25°C±10°C)
		Digital input	Within 0.01% of the set output frequency
	Voltage/frequency characteristics		Base frequency can be set from 0 to 400Hz Constant torque/variable torque pattern or adjustable 5 points V/F can be selected
	Starting torque		150% at 0.3Hz (under Real sensorless vector control or vector control *1)
	Torque boost		Manual torque boost
	Acceleration/deceleration time setting		0 to 3600s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode, backlash measures acceleration/deceleration mode are available.
	DC injection brake		Operation frequency (0 to 120Hz), operation time (0 to 10s), operation voltage (0 to 30%) can be changed
	Stall prevention operation level		Operation current level can be set (0 to 220% adjustable), whether to use the function or not can be selected
	Torque limit level		Torque limit value can be set (0 to 400% variable)
Operation specifications	Frequency setting signal	Analog input	• Terminal 2, 4: 0 to 10V, 0 to 5V, 4 to 20mA (0 to 20mA) can be selected• Terminal 1: -10 to +10V, -5 to +5V can be selected
		Digital input	Input using the setting dial of the operation panel or parameter unit Four-digit BCD or 16 bit binary (when used with option FR-A7AX)
	Start signal		Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected.
	Input signals (twelve terminals)		The following signals can be assigned to *Pr. 178 to Pr. 189 (input terminal function selection)*: multi speed selection, remote setting, stop-on-contact, second function selection, third function selection, terminal 4 input selection, jog operation selection, selection of automatic restart after instantaneous power failure, flying start, external thermal relay input, PU operation/external inter lock signal, external DC injection brake operation start, PID control enable terminal, brake opening completion signal, PU operation/External operation switchover, load pattern selection forward rotation reverse rotation boost, V/F switching, load torque high-speed frequency, S-pattern acceleration/deceleration C switchover, pre-excitation, output stop, start self-holding selection, control mode changing, torque limit selection, start-time tuning start external input, torque bias selection 1, 2*1, P/PI control switchover, forward rotation command, reverse rotation command, inverter reset, PTC thermistor input, PID forward reverse operation switchover, PU-NET operation switchover, NET-External operation switchover, command source switchover, simple position pulse train sign*1, simple position droop pulse clear*1, magnetic flux decay output shutoff.
	Pulse train input		100kpps
	Operational functions		Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, polarity reversible operation, automatic restart after instantaneous power failure operation, electronic bypass operation, forward/reverse rotation prevention, remote setting, brake sequence, second function, third function, multi-speed operation, original operation continuation at instantaneous power failure, stop-on-contact control, load torque high speed frequency control, droop control, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning function, online auto tuning function, PID control, computer link operation (RS-485), motor end orientation *1, machine end orientation *2, pre-excitation, notch filter, machine analyzer *1, easy gain tuning, speed feed forward, and torque bias *1
	Output signals Open collector output (5 terminals) relay output (1 terminal)		The following signals can be assigned to *Pr. 190 to Pr. 196 (output terminal function selection)*: inverter running, inverter running/start command on, up-to-frequency, instantaneous power failure/undervoltage, overload warning, output frequency (speed) detection, second output frequency (speed) detection, third output frequency (speed) detection, electronic thermal relay function pre-alarm, PU operation mode, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward rotation reverse rotation output, electronic bypass MC1, electronic bypass MC2, electronic bypass MC3, orientation fault *1, brake opening request, fan fault output, heatsink overheat pre-alarm, deceleration at an instantaneous power failure, PID control activated, during retry, PID output interruption, position control preparation ready *1, life alarm, fault output 1, 2, 3 (power-off signal), power savings average value update timing, current average monitor, maintenance timer alarm, remote output, forward rotation output *1, reverse rotation output *1, low speed output, torque detection, regenerative status output *1, start-time tuning completion, in-position completion *1, alarm output and fault output. Alarm code of the inverter can be output (4 bit) from the open collector.
	Operating status		
	When used with the FR-A7AY, FR-A7AR (option)		In addition to above, the following signal can be assigned to *Pr.313 to Pr. 319 (extension output terminal function selection)*: control circuit capacitor life, main circuit capacitor life, cooling fan life, inrush current limit circuit life. (only positive logic can be set for extension terminals of the FR-A7AR)
	Pulse train output		50kpps
	For meter Pulse train output (Max. 2.4kHz: one terminal) Analog output (Max. 10VDC: one terminal)		The following signals can be assigned to *Pr. 54 FM terminal function selection (pulse train output)* and *Pr. 158 AM terminal function selection (analog output)*: output frequency, motor current (steady or peak value), output voltage, frequency setting, operation speed, motor torque, converter output voltage (steady or peak value), electronic thermal relay function load factor, input power, output power, load meter, motor excitation current, reference voltage output, motor load factor, power saving effect, PID set point, PID measured value, motor output, torque command, torque current command, and torque monitor.
Indication	Operation panel (FR-DU07) Parameter unit (FR-PU07)	Operating status	The following operating status can be displayed: Output frequency, motor current (steady or peak value), output voltage, frequency setting, running speed, motor torque, overload, converter output voltage (steady or peak value), electronic thermal relay function load factor, input power, output power, load meter, motor excitation current, position pulse*1, cumulative energization time, orientation status *1, actual operation time, motor load factor, cumulative power, energy saving effect, cumulative saving power, regenerative brake duty, PID set point, PID measured value, PID deviation, inverter I/O terminal monitor, input terminal option monitor*3, output terminal option monitor*3, option fitting status*4, terminal assignment status*4, torque command, torque current command, feed back pulse*1, motor output
		Fault record	Fault record is displayed when a fault occurs, the output voltage/current/frequency/cumulative energization time right before the fault occurs and past 8 fault records are stored.
		Interactive guidance	Function (help) for operation guide*4
Protective/ warning function		Protective function	Overcurrent during acceleration, overcurrent during constant speed, overcurrent during deceleration, overvoltage during acceleration, overvoltage during constant speed, overvoltage during deceleration, inverter protection thermal operation, motor protection thermal operation, heatsink overheat, instantaneous power failure occurrence, undervoltage, input phase loss *6, motor overload, output side earth (ground) fault overcurrent, output short circuit, main circuit element overheat, output phase loss, external thermal relay operation*6, PTC thermistor operation*6, option fault, parameter error, PU disconnection, retry count excess*6, CPU fault, operation panel power supply short circuit, 24VDC power output short circuit, output current detection value excess*6, inrush current limit circuit fault, communication fault (inverter), USB fault, opposite rotation deceleration fault*6, analog input fault, speed deviation large *1*6, overspeed *1*6, excessive position fault *1*6, signal loss detection *1*6, brake sequence fault*6, encoder phase error *1*6, regeneration converter overcurrent, regeneration converter circuit fault, regeneration converter transistor protection thermal, internal circuit fault, power supply fault
		Warning function	Fan fault, overcurrent stall prevention, overvoltage stall prevention, electronic thermal relay function prealarm, PU stop, maintenance timer alarm *6, parameter write error, copy operation error, operation panel lock, password locked, parameter copy alarm, speed limit indication
Environment	Surrounding air temperature		-10°C to +50°C (non-freezing)
	Ambient humidity		90%RH maximum (non-condensing)
	Storage temperature*5		-20°C to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.)
	Altitude/vibration		Maximum 1000mabove sea level for standard operation. 5.9m/s^2 or less at 10 to 55Hz (directions of X, Y, Z axes)

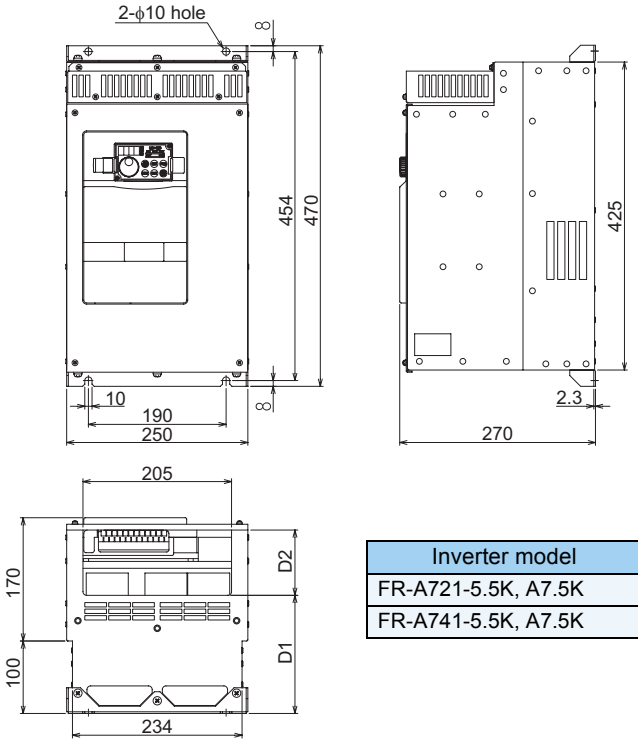
*1 Available only when the option (FR-A7AP/FR-A7AL) is mounted.
*2 Available only when the option (FR-A7AL) is mounted.
*3 Can be displayed only on the operation panel (FR-DU07).
*4 Can be displayed only on the parameter unit (FR-PU07).
*5 Temperature applicable for a short period in transit, etc.
*6 This protective function is not available in the initial status.

7.3 Outline dimension drawings

7.3.1 Inverter outline dimension drawings

●FR-A721-5.5K, 7.5K

●FR-A741-5.5K, 7.5K

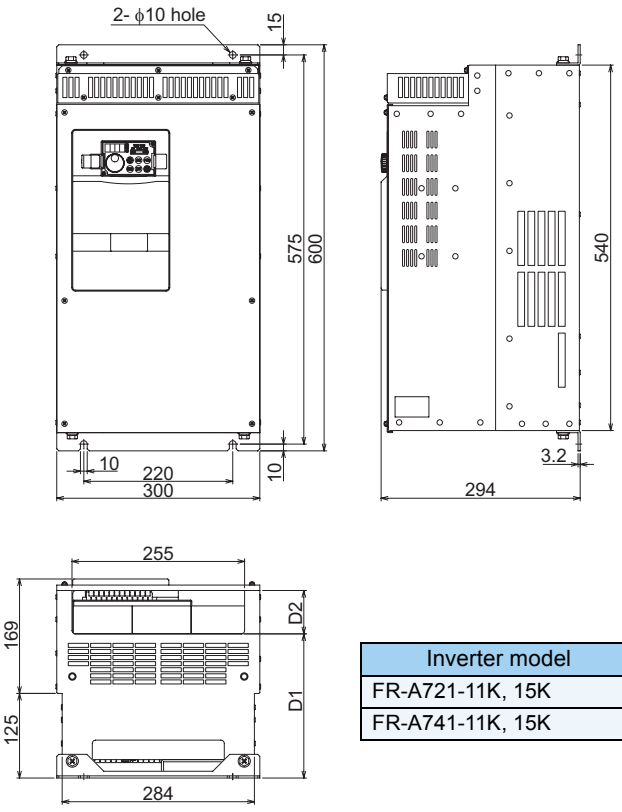


Inverter model	D1	D2
FR-A721-5.5K, A7.5K	163	90
FR-A741-5.5K, A7.5K	168	85

(Unit: mm)

●FR-A721-11K, 15K

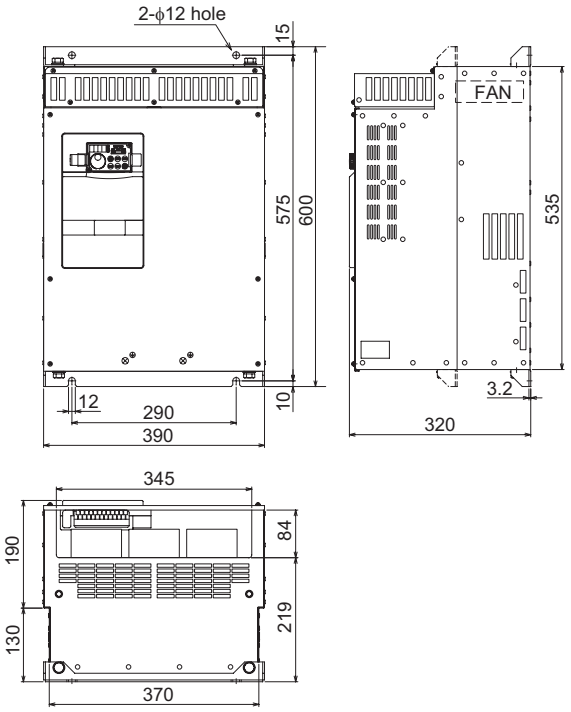
●FR-A741-11K, 15K



Inverter model	D1	D2
FR-A721-11K, 15K	213	64
FR-A741-11K, 15K	224	53

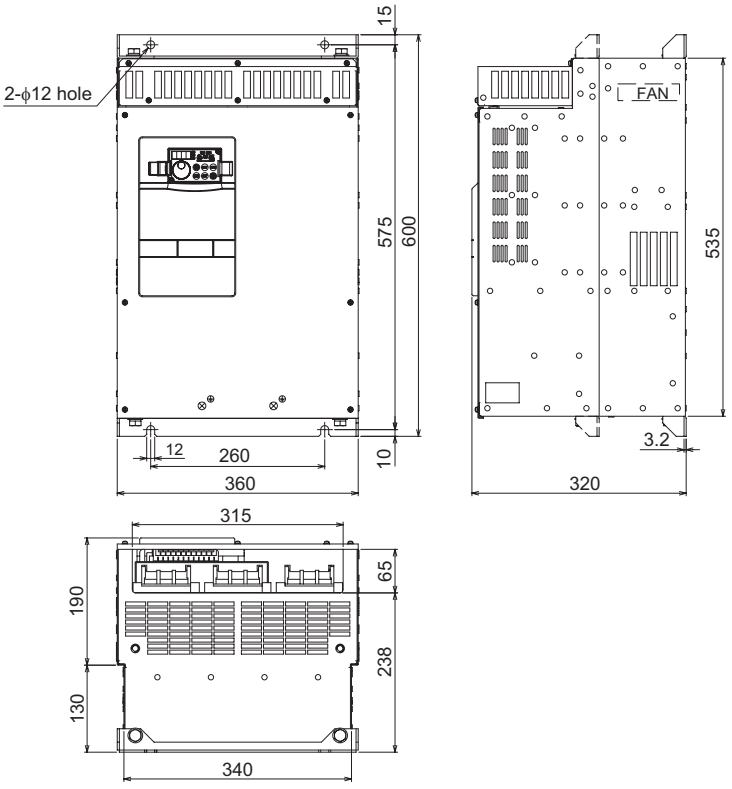
(Unit: mm)

●FR-A721-18.5K, 22K



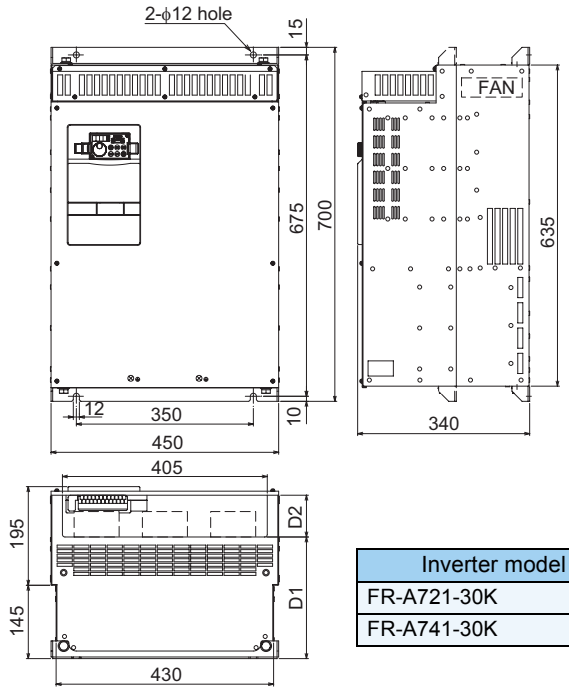
(Unit: mm)

●FR-A741-18.5K, 22K



(Unit: mm)

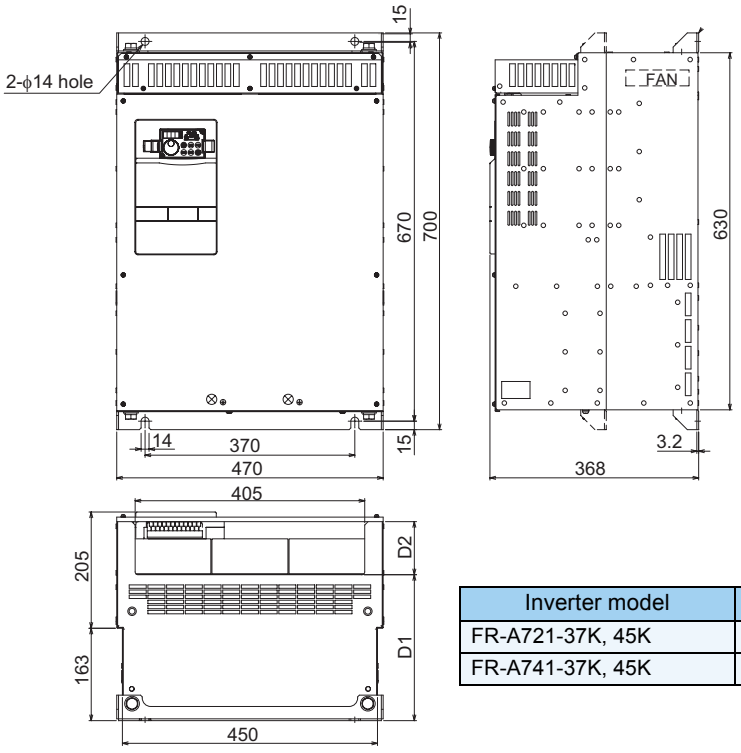
●FR-A721-30K
●FR-A741-30K



Inverter model	D1	D2
FR-A721-30K	240.5	82.5
FR-A741-30K	252.5	70.5

(Unit: mm)

●FR-A721-37K, 45K
●FR-A741-37K, 45K

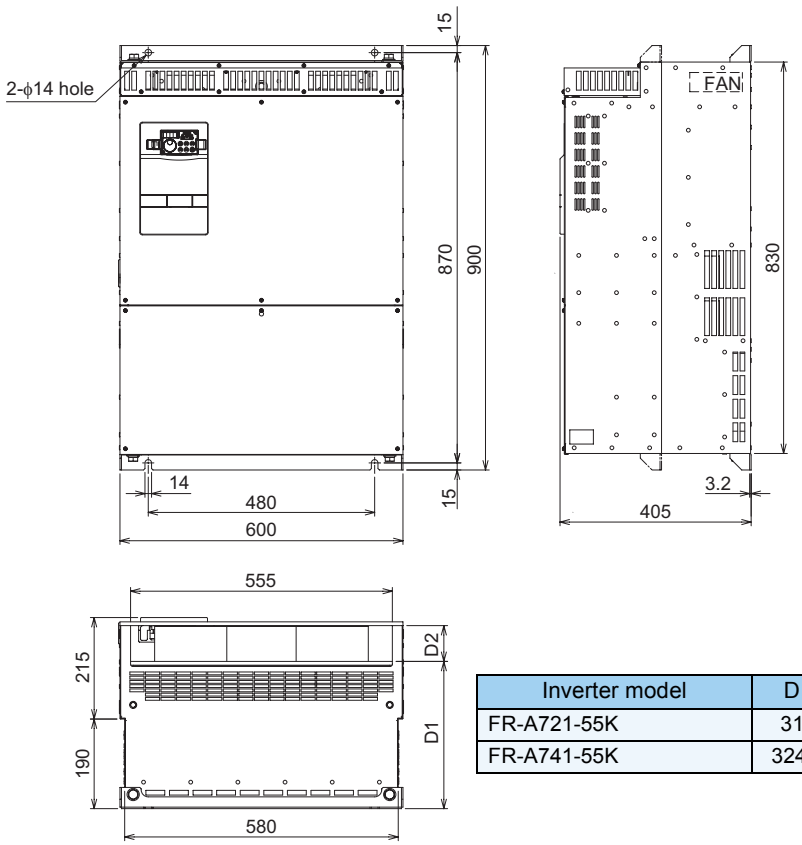


Inverter model	D1	D2
FR-A721-37K, 45K	257.5	93.5
FR-A741-37K, 45K	281.5	69.5

(Unit: mm)

●FR-A721-55K

●FR-A741-55K

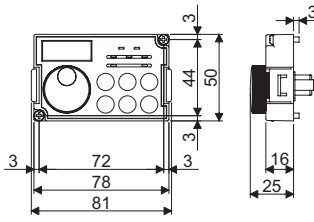


Inverter model	D1	D2
FR-A721-55K	312	76
FR-A741-55K	324.5	64

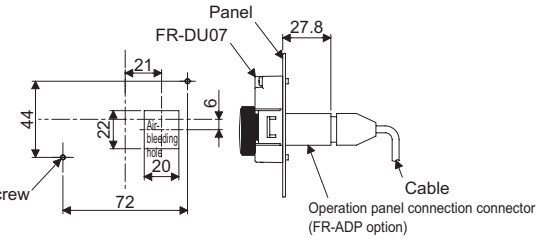
(Unit: mm)

● Operation panel (FR-DU07)

<Outline drawing>



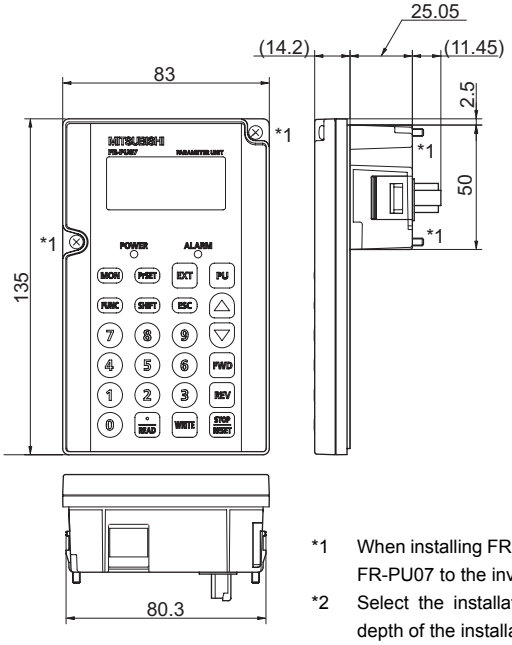
<Panel cutting dimension drawing>



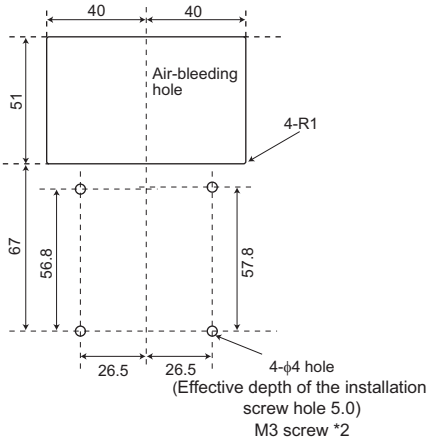
(Unit: mm)

● Parameter unit (option) (FR-PU07)

<Outline drawing>



<Panel cutting dimension drawing>



*1 When installing FR-PU07 on the enclosure, etc., remove screws for fixing the FR-PU07 to the inverter or fix the screws to the FR-PU07 with M3 nuts.

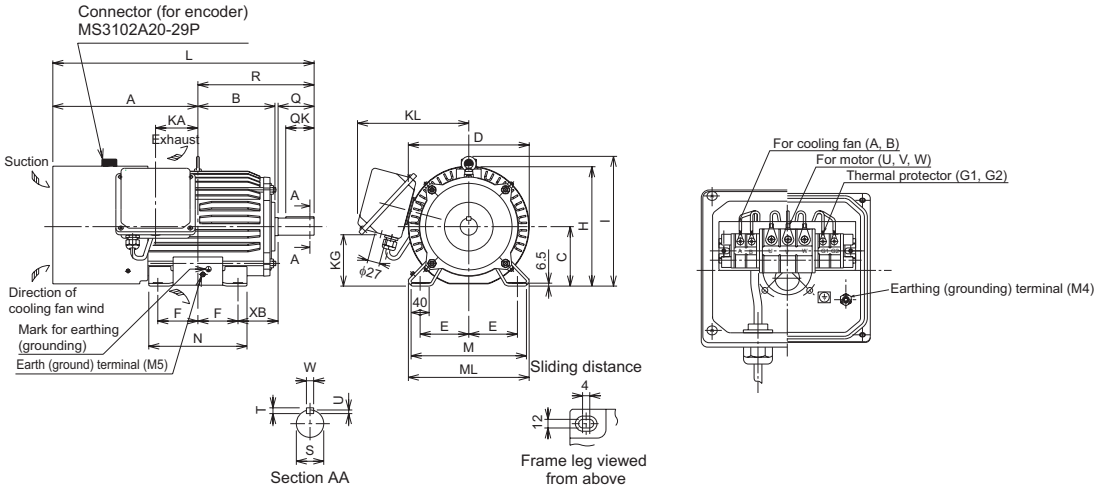
*2 Select the installation screws whose length will not exceed the effective depth of the installation screw hole.

(Unit: mm)

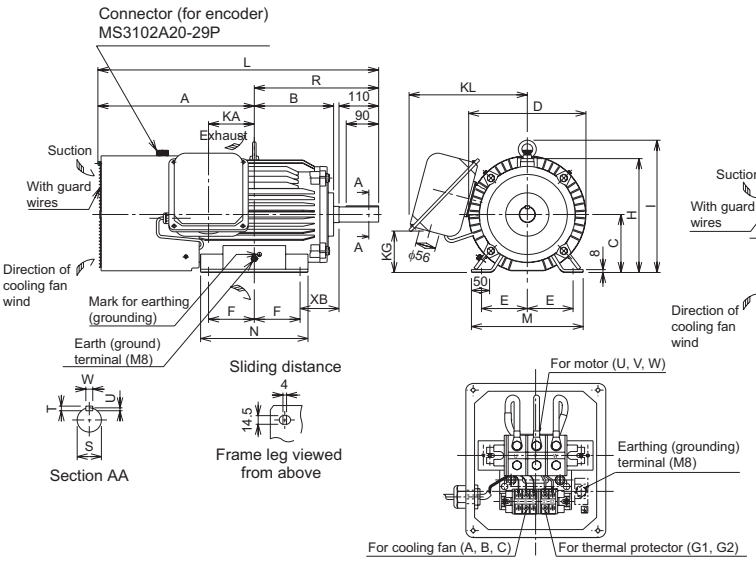
7.3.2 Dedicated motor outline dimension drawings

● Dedicated motor (SF-V5RU(H)) outline dimension drawings (standard horizontal type)

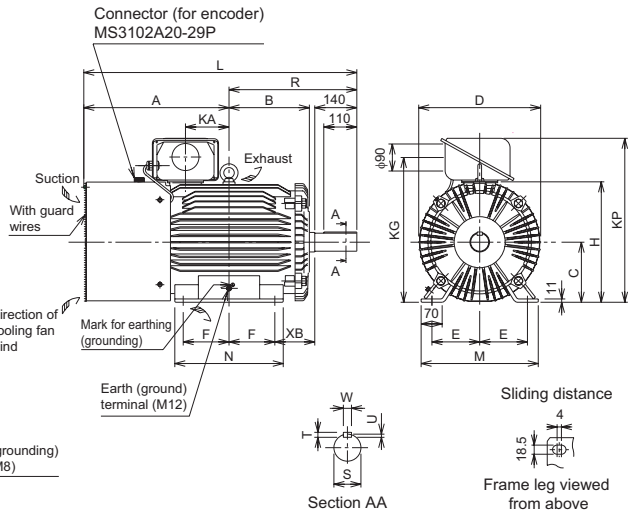
Frame Number 112M, 132S, 132M
SF-V5RU(H) 3K, 5K, 7K



Frame Number 160M, 160L, 180M, 180L
SF-V5RU(H) 11K, 15K, 18K, 22K



Frame Number 200L
SF-V5RU(H) 30K, 37K, 45K



Make sure to earth the earth terminal of the frame installation foot as well as the earth terminal in the terminal box.

Dimensions table

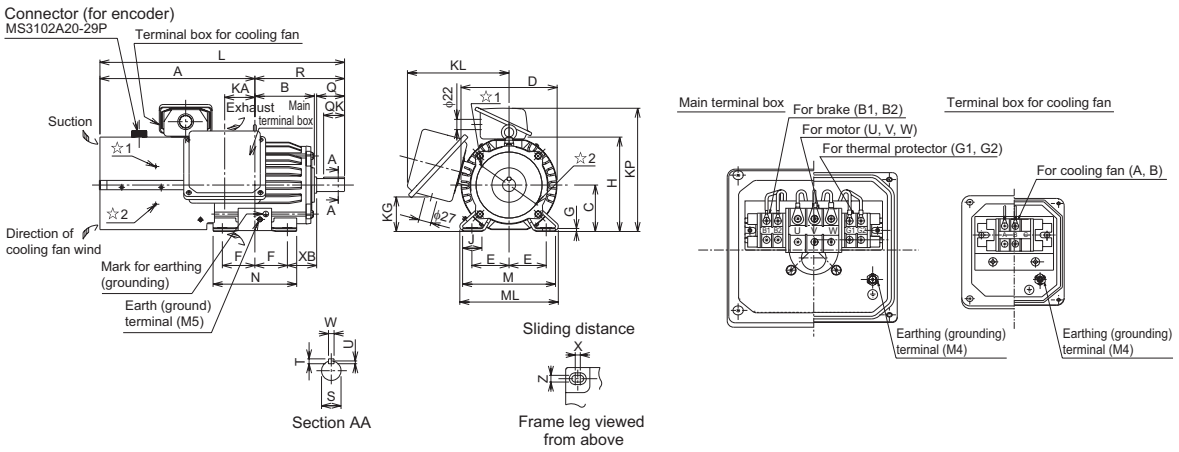
(Unit: mm)

SF-V5RU □K	SF-V5RU □K1	SF-V5RU □K3	SF-V5RU □K4	Frame No.	Mass (kg)	Motor																							Terminal Screw Size		
						A	B	C	D	E	F	H	I	KA	KG	KL(KP)	L	M	ML	N	XB	Q	QK	R	S	T	U	W	U,V,W	A,B,(C)	G1,G2
3	—	—	—	112M	41	278	135	112	228	95	70	226	253	69	93	242	478	230	242	180	70	60	45	200	28j6	7	4	8	M6	M4	M4
5	3	—	—	132S	52	303	152	132	266	108	70	265	288	75	117	256	542	256	268	180	89	80	63	239	38k6	8	5	10	M6	M4	M4
7	5	3	—	132M	62	322	171	132	266	108	89	265	288	94	117	256	580	256	268	218	89	80	63	258	38k6	8	5	10	M6	M4	M4
11	7	5	—	160M	99	412	198	160	318	127	105	316	367	105	115	330	735	310	—	254	108	—	—	323	42k6	8	5	12	M8	M4	M4
15	11	7	3	160L	113	434	220	160	318	127	127	316	367	127	115	330	779	310	—	298	108	—	—	345	42k6	8	5	12	M8	M4	M4
18	—	—	—	180M	138	438.5	225.5	180	363	139.5	120.5	359	410	127	139	352	790	335	—	285	121	—	—	351.5	48k6	9	5.5	14	M8	M4	M4
22	15	11	—		160																										
—	18	15	5	180L	200	457.5	242.5	180	363	139.5	139.5	359	410	146	139	352	828	335	—	323	121	—	—	370.5	55m6	10	6	16	M8	M4	M4
30	—	—	7	200L	238	483.5	267.5	200	406	159	152.5	401	—	145	487	(546)	909	390	—	361	133	—	—	425.5	60m6	—	—	—	M10	M4	M4
37, 45	22, 30	18, 22	—		255																										
—	37	30	11, 15	225S	320	500	277	225	446	178	143	446	—	145	533	(592)	932	428	—	342	149	—	—	432	65m6	—	—	—	M10	M4	M4

Note) 1. Install the motor on the floor and use it with the shaft horizontal.
2. Leave an enough clearance between the fan suction port and wall to ensure adequate cooling.
Also, check that the ventilation direction of a fan is from the opposite load side to the load side.
3 The size difference of top and bottom of the shaft center height is $^{0}_{-0.5}$
4 The 400V class motor has -H at the end of its type name.

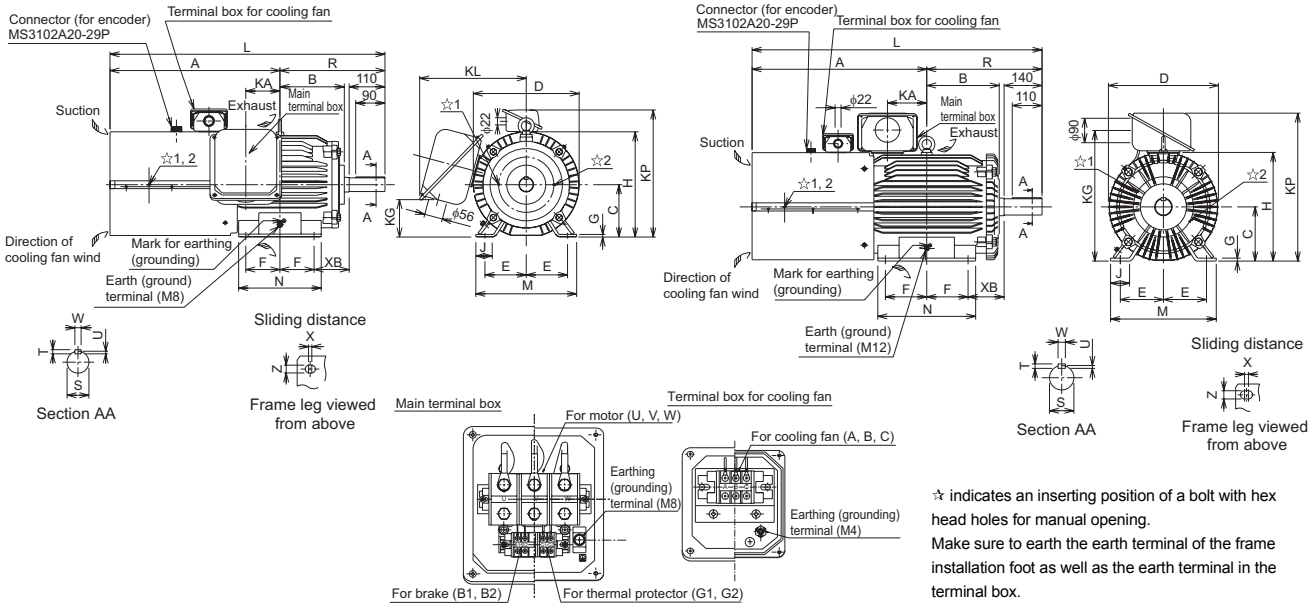
● Dedicated motor (SF-V5RU(H)) outline dimension drawings (standard horizontal type with brake)

Frame Number 112M, 132S, 132M
SF-V5RU(H) 3KB , 5KB , 7KB



Frame Number 160M, 160L, 180M, 180L
SF-V5RU(H) 11KB , 15KB , 18KB , 22KB

Frame Number 200L
SF-V5RU(H) 30KB , 37KB , 45KB



☆ indicates an inserting position of a bolt with hex head holes for manual opening.
Make sure to earth the earth terminal of the frame installation foot as well as the earth terminal in the terminal box.

Dimensions table

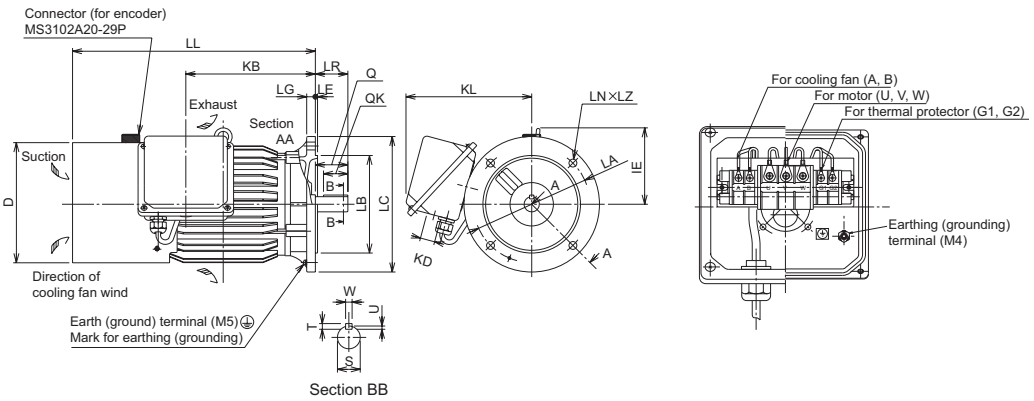
(Unit: mm)

SF-V5RU □K	SF-V5RU □K1	SF-V5RU □K3	SF-V5RU □K4	Frame No.	Mass (kg)	Motor																						Shaft End							Terminal Screw Size			
						A	B	C	D	E	F	G	H	I	J	KA	KD	KG	KL	KP	L	M	ML	N	X	XB	Z	Q	QK	R	S	T	U	W	U,V,W	A,B,(C)	G1,G2	B1,B2
3	—	—	—	112M	53	355	135	112	228	95	70	6.5	—	—	40	69	27	93	242	290	555	230	242	180	4	70	12	60	45	200	28j6	7	4	8	M6	M4	M4	M4
5	3	—	—	132S	70	416	152	132	266	108	70	6.5	—	—	40	75	27	117	256	329	655	256	268	180	4	89	12	80	63	239	38k6	8	5	10	M6	M4	M4	M4
7	5	3	—	132M	80	435	171	132	266	108	89	6.5	—	—	40	94	27	117	256	329	693	256	268	218	4	89	12	80	63	258	38k6	8	5	10	M6	M4	M4	M4
11	7	5	—	160M	140	522.5	198	160	318	127	105	8	—	—	50	105	56	115	330	391	845.5	310	—	254	4	108	14.5	110	90	323	42k6	8	5	12	M8	M4	M4	M4
15	11	7	3	160L	155	544.5	220	160	318	127	127	8	—	—	50	127	56	115	330	391	889.5	310	—	298	4	108	14.5	110	90	345	42k6	8	5	12	M8	M4	M4	M4
18	—	—	—	180M	185	568.5	225.5	180	363	139.5	120.5	8	—	—	50	127	56	139	352	428	920	335	—	285	4	121	14.5	110	90	351.5	48k6	9	5.5	14	M8	M4	M4	M4
22	15	11	—		215																																	
—	18	15	5	180L	255	587.5	242.5	180	363	139.5	139.5	8	—	—	50	146	56	139	352	428	958	335	—	323	4	121	14.5	110	90	370.5	55m6	10	6	16	M8	M4	M4	M4
30	—	—	7	200L	305	644.5	267.5	200	406	159	152.5	11	—	—	70	145	90	487	—	546	1070	390	—	361	4	133	18.5	140	110	425.5	60m6	11	7	18	M10	M4	M4	M4
37, 45	22, 30	18, 22	—		330																																	
—	37	30	11, 15	225S	395	659	277	225	446	178	143	11	—	—	70	145	90	533	—	592	1091	428	—	342	4	149	18.5	140	110	432	65m6	11	7	18	M10	M4	M4	M4

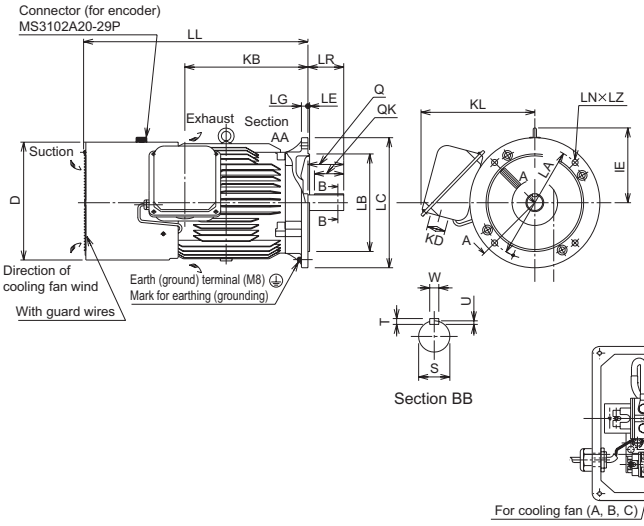
Note) 1. Install the motor on the floor and use it with the shaft horizontal.
2. Leave an enough clearance between the fan suction port and wall to ensure adequate cooling.
Also, check that the ventilation direction of a fan is from the opposite load side to the load side.
3. The size difference of top and bottom of the shaft center height is $^{0}_{-0.5}$
4. The 400V class motor has -H at the end of its type name.
5. Since a brake power device is a stand-alone, install it inside the enclosure.
(This device should be arranged at the customer side.)

● Dedicated motor (SF-V5RU(H)) outline dimension drawings (flange type)

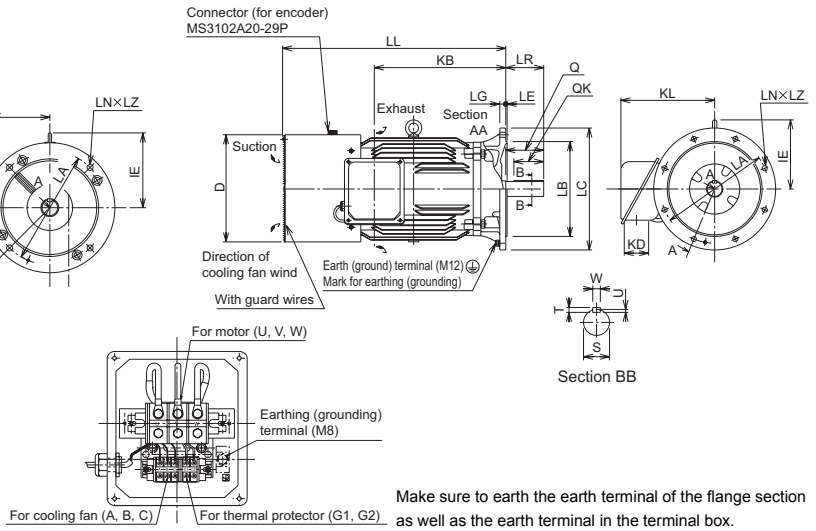
Frame Number 112M, 132S, 132M
SF-V5RUF(H) 3K, 5K, 7K



Frame Number 160M, 160L, 180M, 180L
SF-V5RUF(H) 11K, 15K, 18K, 22K



Frame Number 200L
SF-V5RUF(H) 30K, 37K, 45K



Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

Dimensions table

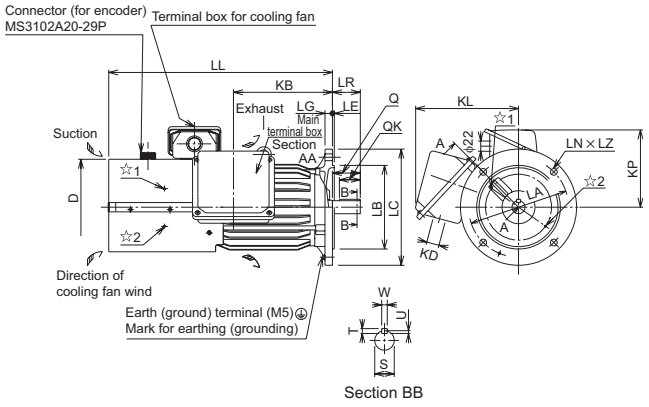
(Unit: mm)

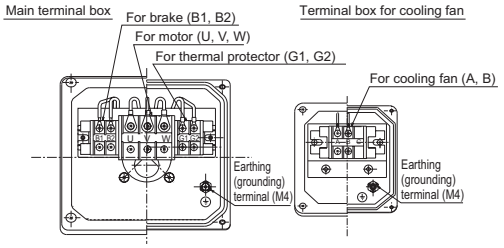
SF-V5RU □K	SF-V5RU □K1	SF-V5RU □K3	SF-V5RU □K4	Flange Number	Frame No.	Mass (kg)	Motor													Shaft End							Terminal Screw Size		
							D	IE	KB	KD	KL	LA	LB	LC	LE	LG	LL	LN	LZ	LR	Q	QK	S	T	U	W	U,V,W	A,B,(C)	G1,G2
3	—	—	—	FF215	112M	46	228	141	239	27	242	215	180j6	250	4	16	448	4	14.5	60	60	45	28j6	7	4	8	M6	M4	M4
5	3	—	—	FF265	132S	65	266	156	256	27	256	265	230j6	300	4	20	484	4	14.5	80	80	63	38k6	8	5	10	M6	M4	M4
7	5	3	—	FF265	132M	70	266	156	294	27	256	265	230j6	300	4	20	522	4	14.5	80	80	63	38k6	8	5	10	M6	M4	M4
11	7	5	—	FF300	160M	110	318	207	318	56	330	300	250j6	350	5	20	625	4	18.5	110	110	90	42k6	8	5	12	M8	M4	M4
15	11	7	3	FF300	160L	125	318	207	362	56	330	300	250j6	350	5	20	669	4	18.5	110	110	90	42k6	8	5	12	M8	M4	M4
18	—	—	—	FF350	180M	160	363	230	378.5	56	352	350	300j6	400	5	20	690	4	18.5	110	110	90	48k6	9	5.5	14	M8	M4	M4
22	15	11	—			185																							
—	18	15	5	FF350	180L	225	363	230	416.5	56	352	350	300j6	400	5	20	728	4	18.5	110	110	90	55m6	10	6	16	M8	M4	M4
30	—	—	7	FF400	200L	270	406	255	485	90	346	400	350j6	450	5	22	823.5	8	18.5	140	140	110	60m6	11	7	18	M10	M4	M4
37, 45	22, 30	18, 22	—			290																							

Note) 1. Install the motor on the floor and use it with the shaft horizontal.
For use under the shaft, the protection structure of the cooling fan is IP20.
2. Leave an enough clearance between the fan suction port and wall to ensure adequate cooling.
Also, check that the ventilation direction of a fan is from the opposite load side to the load side.
3. The size difference of top and bottom of the shaft center height is $^{0}_{-0.5}$
4 The 400V class motor has -H at the end of its type name.

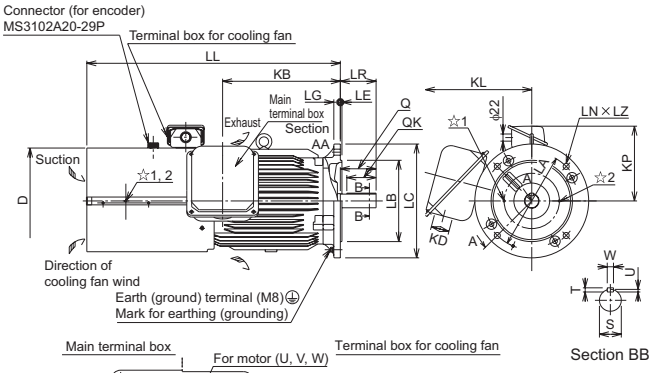
● Dedicated motor (SF-V5RU(H)) outline dimension drawings (flange type with brake)

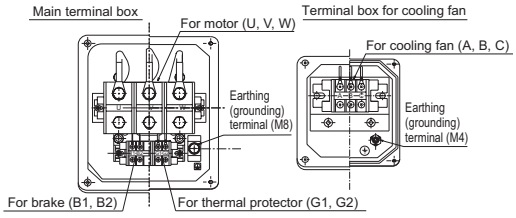
Frame Number 112M, 132S, 132M
SF-V5RUF(H) 3KB, 5KB, 7KB





Frame Number 160M, 160L
SF-V5RUF(H) 11KB, 15KB





☆ indicates an inserting position of a bolt with hex head holes for manual opening.

Make sure to earth the earth terminal of the flange section as well as the earth terminal in the terminal box.

Dimensions table

(Unit: mm)

SF-V5RU □K	SF-V5RU □K1	SF-V5RU □K3	SF-V5RU □K4	Flange Number	Frame No.	Mass (kg)	Motor													Shaft End							Terminal Screw Size			
							D	KB	KD	KL	KP	LA	LB	LC	LE	LG	LL	LN	LZ	LR	Q	QK	S	T	U	W	U,V,W	A,B,(C)	B1,B2	G1,G2
3	—	—	—	FF215	112M	58	228	239	27	242	178	215	180j6	250	4	16	525	4	14.5	60	60	45	28j6	7	4	8	M6	M4	M4	M4
5	3	—	—	FF265	132S	83	266	256	27	256	197	265	230j6	300	4	20	597	4	14.5	80	80	63	38k6	8	5	10	M6	M4	M4	M4
7	5	3	—	FF265	132M	88	266	294	27	256	197	265	230j6	300	4	20	635	4	14.5	80	80	63	38k6	8	5	10	M6	M4	M4	M4
11	7	5	—	FF300	160M	151	318	318	56	330	231	300	250j6	350	5	20	735.5	4	18.5	110	110	90	42k6	8	5	12	M8	M4	M4	M4
15	11	7	3	FF300	160L	167	318	362	56	330	231	300	250j6	350	5	20	779.5	4	18.5	110	110	90	42k6	8	5	12	M8	M4	M4	M4

Note) 1. Install the motor on the floor and use it with the shaft horizontal.
2. Leave an enough clearance between the fan suction port and wall to ensure adequate cooling.
Also, check that the ventilation direction of a fan is from the opposite load side to the load side.
3. The size difference of top and bottom of the shaft center height is $^{0}_{-0.5}$
4. The 400V class motor has -H at the end of its type name.
5. Since a brake power device is a stand-alone, install it inside the enclosure.
(This device should be arranged at the customer side.)

7.4 Installation of the heatsink portion outside the enclosure for use

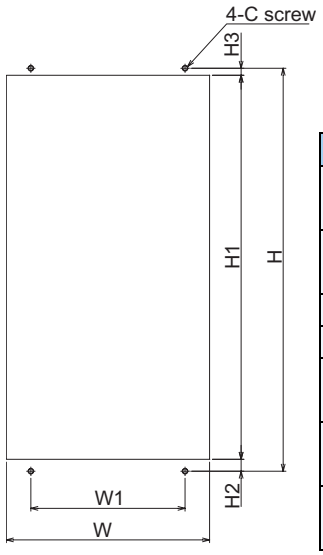
When encasing the inverter in an enclosure, the generated heat amount in an enclosure can be greatly reduced by installing the heatsink portion of the inverter outside the enclosure. When installing the inverter in a compact enclosure, etc., this installation method is recommended.

7.4.1 Protrusion of heatsink

(1) Panel cutting

Cut the panel of the enclosure according to the inverter capacity.

• FR-A721-5.5K to 55K, FR-A741-5.5K to 55K

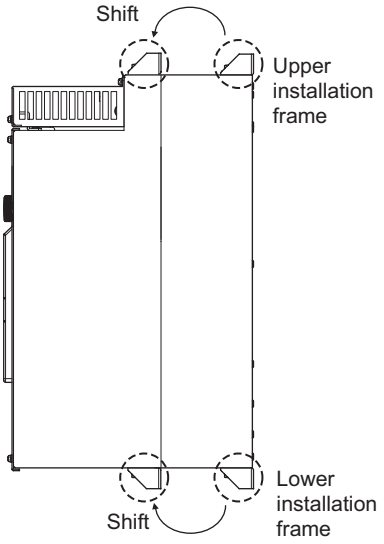


Inverter model	W	W1	H	H1	H2	H3	C
FR-A721-5.5K, 7.5K FR-A741-5.5K, 7.5K	240	190	454	434	12	8	M8
FR-A721-11K, 15K FR-A741-11K, 15K	290	220	575	548	17	10	M8
FR-A721-18.5K, 22K	376	290	575	546	17	12	M10
FR-A741-18.5K, 22K	346	260	575	546	17	12	M10
FR-A721-30K FR-A741-30K	436	350	675	646	17	12	M10
FR-A721-37K, 45K FR-A741-37K, 45K	456	370	670	641	17	12	M12
FR-A721-55K FR-A741-55K	586	480	870	841	17	12	M12

Unit: mm

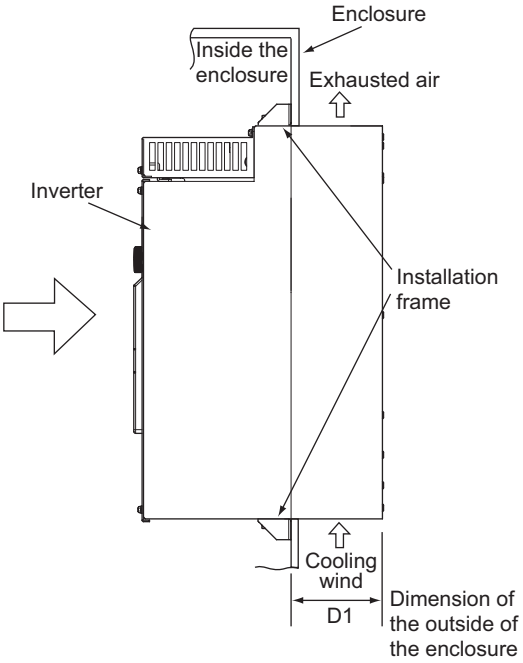
(2) Shift and removal of a rear side installation frame

One installation frame is attached to each of the upper and lower parts of the inverter. Change the position of the rear side installation frame on the upper and lower sides of the inverter to the front side as shown on the right. When changing the installation frames, make sure that the installation orientation is correct.



(3) Installation of the inverter

Push the inverter heatsink portion outside the enclosure and fix the enclosure and inverter with upper and lower installation frame.



Inverter model	D1
FR-A721-5.5K, 7.5K FR-A741-5.5K, 7.5K	100
FR-A721-11K, 15K FR-A741-11K, 15K	125
FR-A721-18.5K, 22K FR-A741-18.5K, 22K	130
FR-A721-30K FR-A741-30K	145
FR-A721-37K, 45K FR-A741-37K, 45K	163
FR-A721-55K FR-A741-55K	190

(Unit: mm)

CAUTION

- Having a cooling fan, the cooling section which comes out of the enclosure can not be used in the environment of water drops, oil, mist, dust, etc.
- Be careful not to drop screws, dust etc. into the inverter and cooling fan section.

APPENDICES

Appendix 1 Main differences and compatibilities with the FR-A700 series

Item	FR-A700	FR-A701
Model configuration	200V class .....0.4K to 90K 400V class .....0.4K to 500K	200V class ..... 5.5K to 55K 400V class ..... 5.5K to 55K
Regenerative braking torque	5.5/7.5K.....100%torque 2%ED 11K to 55K.....20%torque continuous	100% torque/continuous 150% torque 60s
Built-in EMC filter	With	Without
Changed/cleared functions	*Pr. 30 Regenerative function selection, Pr. 70 Special regenerative brake duty*	Deleted
	Pr. 872 Input phase loss protection selection Initial value "0" (without input phase protection)	The initial value is changed to "1" (with input phase failure protection)
	Protective functions E.BE	Deleted E.4, E.10, E.8, E.15 added
Stand-alone option	· AC reactor (FR-HAL) · DC reactor (FR-HEL) · High-duty brake resistor (FR-ABR) · Power regeneration common converter (FR-CV) · High power factor converter (FR-HC) · Power regeneration converter (FR-RC)	Not available (AC reactor (FR-HAL) is built-in) * Note that an AC reactor (FR-HAL) should be used only when a thyristor load exists in the same power supply system and protective function E.4 and E.10 activate.
Outline dimension Installation size	Not compatible	

Appendix 2 Instructions for compliance with the EU Directives (400V class only)

The EU Directives are issued to standardize different national regulations of the EU Member States and to facilitate free movement of the equipment, whose safety is ensured, in the EU territory.
Since 1996, compliance with the EMC Directive that is one of the EU Directives has been legally required. Since 1997, compliance with the Low Voltage Directive, another EU Directive, has been also legally required. When a manufacturer confirms its equipment to be compliant with the EMC Directive and the Low Voltage Directive, the manufacturer must declare the conformity and affix the CE marking.

● **The authorized representative in the EU**

The authorized representative in the EU is shown below.
Name: Mitsubishi Electric Europe B.V.
Address: Gothaer Strasse 8, 40880 Ratingen, Germany

● Note

We declare that this inverter, when equipped with the dedicated EMC filter, conforms with the EMC Directive in industrial environments and affix the CE marking on the inverter. When using the inverter in a residential area, take appropriate measures and ensure the conformity of the inverter used in the residential area.

(1) EMC Directive

We declare that this inverter (400V class only), when equipped with the EMC Directive compliant EMC filter, conforms with the EMC Directive and affix the CE marking on the inverter.

- EMC Directive: 2004/108/EC
- Standard(s): EN61800-3:2004 (Second environment / PDS Category "C3")

Note: First environment

Environment including residential buildings. Includes building directly connected without a transformer to the low voltage power supply network which supplies power to residential buildings.

Second environment

Environment including all buildings except buildings directly connected without a transformer to the lower voltage power supply network which supplies power to residential buildings.

● Note

* Set the EMC Directive compliant EMC filter to the inverter. Insert line noise filters and ferrite cores to the power and control cables as required.
* Connect the inverter to an earthed power supply.
* Install a motor, the EMC Directive compliant EMC filter, and a control cable according to the instructions written in the EMC Installation Guidelines (BCN-A21041-204).
* The cable length between the inverter and the motor is 20m maximum.
* Confirm that the final integrated system with the inverter conforms with the EMC Directive

(2) Low Voltage Directive

We have self-confirmed our inverters as products compliant to the Low Voltage Directive (Conforming standard EN 61800-5-1) and affix the CE marking on the inverters.

- Outline of instructions
  - ∗ Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth securely.
  - ∗ Wire the earth (ground) terminal independently. (Do not connect two or more cables to one terminal.)
  - ∗ Use the cable sizes on *page 18* under the following conditions.
    - Surrounding air temperature: 40°C maximum

    If conditions are different from above, select appropriate wire according to EN60204 ANNEX C TABLE 5.
  - ∗ Use a tinned (plating should not include zinc) crimping terminal to connect the earth cable. When tightening the screw, be careful not to damage the threads.
    For use as a product compliant with the Low Voltage Directive, use PVC cable on *page 16*.
  - ∗ Use the moulded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard.
  - ∗ When using an earth leakage circuit breaker, use a residual current operated protective device (RCD) of type B (breaker which can detect both AC and DC). If not, provide double or reinforced insulation between the inverter and other equipment, or put a transformer between the main power supply and inverter.
  - ∗ Use the inverter under the conditions of overvoltage category II (usable regardless of the earth (ground) condition of the power supply), overvoltage category III (usable with the earthed-neutral system power supply) and pollution degree 2 or lower specified in IEC664.
    - To use the inverter under the conditions of pollution degree 2, install it in the enclosure of IP 2X or higher.
    - To use the inverter under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher.

∗On the input and output of the inverter, use cables of the type and size set forth in EN60204 Appendix C.

∗The operating capacity of the relay outputs (terminal symbols A1, B1, C1, A2, B2, C2) should be 30VDC, 0.3A. (Relay output has basic isolation from the inverter internal circuit.)

∗Control circuit terminals on page *12* are safely isolated from the main circuit.

∗Environment

	Running	In Storage	During Transportation
Ambient Temperature	-10°C to +50°C	-20°C to +65°C	-20°C to +65°C
Humidity	90% RH or less	90% RH or less	90% RH or less
Maximum Altitude	1000m	1000m	10000m

Details are given in the technical information "Low Voltage Directive Conformance Guide" (BCN-A21041-203). Please contact your sales representative.

Appendix 3 Instructions for UL and cUL Compliance

(Conforming standard UL 508C, CSA C22.2 No.14)

(1) Installation

This inverter is UL-listed as a product for use in an enclosure.
Design an enclosure so that the inverter surrounding air temperature, humidity and atmosphere satisfy the specifications. *(Refer to page 184.)*

Wiring protection

For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code and any applicable provincial codes.
For installation in Canada, branch circuit protection must be provided in accordance with the Canadian Electrical Code and any applicable provincial codes.
Provide the appropriate UL and cUL listed Class RK5 or Class T type fuse or UL489 molded case circuit breaker (MCCB) that is suitable for branch circuit protection in accordance with the table below.

FR-A721-□□K	5.5	7.5	11	15	18.5	22	30	37	45	55
Rated fuse voltage(V)	240V or more									
Fuse maximum allowable rating (A)*	70	125	150	200	200	250	300	350	400	500
Molded case circuit breaker (MCCB) maximum allowable rating (A)*	60	80	110	150	175	225	250	350	400	500

FR-A741-□□K	5.5	7.5	11	15	18.5	22	30	37	45	55
Rated fuse voltage(V)	480V or more									
Fuse maximum allowable rating (A)*	35	60	70	90	100	125	150	175	200	250

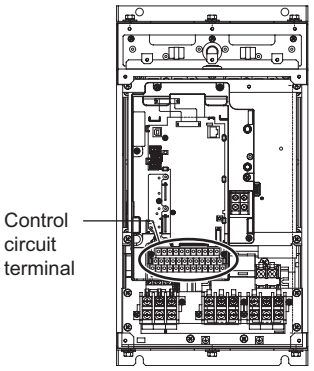
* Maximum allowable rating by US National Electrical Code.
Exact size must be chosen for each installation.

(2) Wiring of the power supply and motor

For wiring the input (R/L1, S/L2, T/L3) and output (U, V, W) terminals of the inverter, use the UL Listed copper, stranded wires (rated at 75°C) and round crimping terminals. Crimp the crimping terminals with the crimping tool recommended by the terminal maker.

(3) Wiring of control circuit

Use a 16-18AWG cupper cable and perform wiring without using crimping terminals.



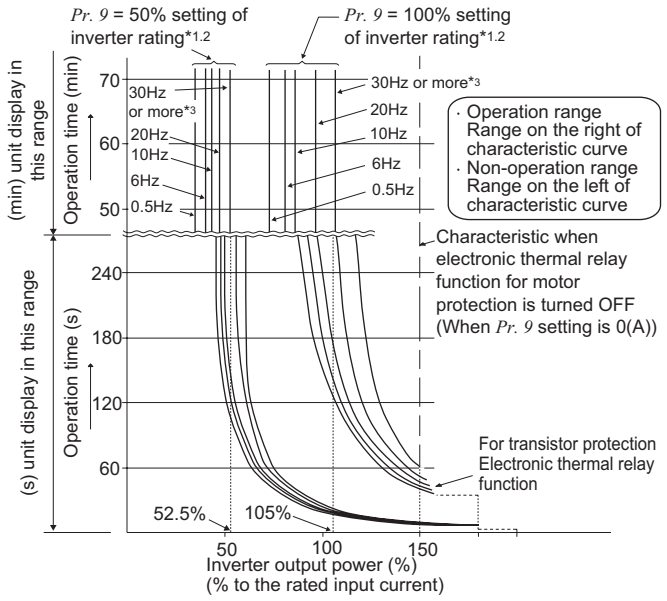
(4) Short circuit ratings

- 200V class
  Suitable For Use in A Circuit Capable Of Delivering Not More Than 100kA rms Symmetrical Amperes, 264V Maximum.
- 400V class
  Suitable For Use in A Circuit Capable Of Delivering Not More Than 100kA rms Symmetrical Amperes, 528V Maximum.

(5) Motor overload protection

This inverter is certified as a motor overload protection device by UL.
When using the electronic thermal relay function as motor overload protection, set the rated motor current to *Pr. 9 Electronic thermal O/L relay*.

Electronic thermal relay function operation characteristic



This function detects the overload (overheat) of the motor, stops the operation of the inverter's output transistor, and stops the output.
(The operation characteristic is shown on the left)

When using the Mitsubishi constant-torque motor

1) Set "1" or any of "13" to "18", "50", "53", "54" in *Pr. 71*.
(This provides a 100% continuous torque characteristic in the low-speed range.)
2) Set the rated current of the motor in *Pr. 9*.

*1 When a value 50% of the inverter rated output current (current value) is set in *Pr. 9*

*2 The % value denotes the percentage to the inverter rated output current. It is not the percentage to the motor rated current.

*3 When you set the electronic thermal relay function dedicated to the Mitsubishi constant-torque motor, this characteristic curve applies to operation at 6Hz or higher.

CAUTION

- Protective function by electronic thermal relay function is reset by inverter power reset and reset signal input. Avoid unnecessary reset and power-off.
- When multiple motors are operated by a single inverter, protection cannot be provided by the electronic thermal relay function. Install an external thermal relay to each motor.
- When the difference between the inverter and motor capacities is large and the setting is small, the protective characteristics of the electronic thermal relay function will be deteriorated. In this case, use an external thermal relay.
- A special motor cannot be protected by the electronic thermal relay function. Use the external thermal relay.
- Electronic thermal relay does not function when 5% or less of inverter rated current is set to electronic thermal relay setting.

Appendix 4 Control mode-based parameter (function) correspondence table and instruction code list

*1 These instruction codes are used for parameter read and write by using Mitsubishi inverter protocol with the RS-485 communication.
(Refer to *Chapter 4 of the Instruction Manual (Applied)* for RS-485 communication)

*2 Validity and invalidity according to operation mode are as follows:
○:Usable parameter
×:Unusable parameter
Δ:Parameters available only during position control set by parameter

*3 "○" indicates valid and "×" indicates invalid of "parameter copy", "parameter clear", and "all parameter clear".

*4 Parameters can be used with conditions. Refer to *Chapter 4 of the Instruction Manual (Applied)* for details.

*5 When a communication option is installed, parameter clear (lock release) during password lock (*Pr. 297* ≠ 9999) can be performed only from the communication option.

*6 These parameters are communication parameters that are not cleared when parameter clear (all clear) is executed from RS-485 communication.
(Refer to *Chapter 4 of the Instruction Manual (Applied)* for RS-485 communication)

Symbols in the table indicate parameters which function when an option is mounted.
AX ..... FR-A7AX, AY ..... FR-A7AY, AR ..... FR-A7AR, AP ..... FR-A7AP, AL ..... FR-A7AL, AZ FR-A7AZ,
NC ..... FR-A7NC, ND ..... FR-A7ND, NL ..... FR-A7NL, NP ..... FR-A7NP, NS FR-A7NS

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
0	Torque boost	00	80	0	○	×	×	×	×	×	×	○	○	○
1	Maximum frequency	01	81	0	○	○	○	○	○	○	○	○	○	○
2	Minimum frequency	02	82	0	○	○	○	○	×	○	○	○	○	○
3	Base frequency	03	83	0	○	×	×	×	×	×	×	○	○	○
4	Multi-speed setting (high speed)	04	84	0	○	○	○	○	Δ	○	○	○	○	○
5	Multi-speed setting (middle speed)	05	85	0	○	○	○	○	Δ	○	○	○	○	○
6	Multi-speed setting (low speed)	06	86	0	○	○	○	○	Δ	○	○	○	○	○
7	Acceleration time	07	87	0	○	○	○	○	Δ	○	○	○	○	○
8	Deceleration time	08	88	0	○	○	○	○	Δ	○	○	○	○	○
9	Electronic thermal O/L relay	09	89	0	○	○	○	○	○	○	○	○	○	○
10	DC injection brake operation frequency	0A	8A	0	○	○	○	○	×	○	○	○	○	○
11	DC injection brake operation time	0B	8B	0	○	○	○	○	×	○	○	○	○	○
12	DC injection brake operation voltage	0C	8C	0	○	○	×	×	×	○*4	○*4	○	○	○
13	Starting frequency	0D	8D	0	○	○	○	○	×	○	○	○	○	○
14	Load pattern selection	0E	8E	0	○	×	×	×	×	×	×	○	○	○
15	Jog frequency	0F	8F	0	○	○	○	○	×	○	○	○	○	○
16	Jog acceleration/ deceleration time	10	90	0	○	○	○	○	×	○	○	○	○	○
17	MRS input selection	11	91	0	○	○	○	○	○	○	○	○	○	○
18	High speed maximum frequency	12	92	0	○	○	×	×	×	×	×	○	○	○
19	Base frequency voltage	13	93	0	○	×	×	×	×	×	×	○	○	○
20	Acceleration/deceleration reference frequency	14	94	0	○	○	○	○	Δ	○	○	○	○	○
21	Acceleration/deceleration time increments	15	95	0	○	○	○	○	Δ	○	○	○	○	○
22	Stall prevention operation level (Torque limit level)	16	96	0	○	○	○	×	○	○	×	○	○	○
23	Stall prevention operation level compensation factor at double speed	17	97	0	○	○	×	×	×	×	×	○	○	○
24	Multi-speed setting (speed 4)	18	98	0	○	○	○	○	Δ	○	○	○	○	○
25	Multi-speed setting (speed 5)	19	99	0	○	○	○	○	Δ	○	○	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
26	Multi-speed setting (speed 6)	1A	9A	0	○	○	○	○	Δ	○	○	○	○	○
27	Multi-speed setting (speed 7)	1B	9B	0	○	○	○	○	Δ	○	○	○	○	○
28	Multi-speed input compensation selection	1C	9C	0	○	○	○	○	×	○	○	○	○	○
29	Acceleration/deceleration pattern selection	1D	9D	0	○	○	○	○	×	○	○	○	○	○
31	Frequency jump 1A	1F	9F	0	○	○	○	○	×	○	○	○	○	○
32	Frequency jump 1B	20	A0	0	○	○	○	○	×	○	○	○	○	○
33	Frequency jump 2A	21	A1	0	○	○	○	○	×	○	○	○	○	○
34	Frequency jump 2B	22	A2	0	○	○	○	○	×	○	○	○	○	○
35	Frequency jump 3A	23	A3	0	○	○	○	○	×	○	○	○	○	○
36	Frequency jump 3B	24	A4	0	○	○	○	○	×	○	○	○	○	○
37	Speed display	25	A5	0	○	○	○	○	○	○	○	○	○	○
41	Up-to-frequency sensitivity	29	A9	0	○	○	○	×	×	○	×	○	○	○
42	Output frequency detection	2A	AA	0	○	○	○	○	○	○	○	○	○	○
43	Output frequency detection for reverse rotation	2B	AB	0	○	○	○	○	○	○	○	○	○	○
44	Second acceleration/ deceleration time	2C	AC	0	○	○	○	○	Δ	○	○	○	○	○
45	Second deceleration time	2D	AD	0	○	○	○	○	Δ	○	○	○	○	○
46	Second torque boost	2E	AE	0	○	×	×	×	×	×	×	○	○	○
47	Second V/F (base frequency)	2F	AF	0	○	×	×	×	×	×	×	○	○	○
48	Second stall prevention operation current	30	B0	0	○	○	×	×	×	×	×	○	○	○
49	Second stall prevention operation frequency	31	B1	0	○	○	×	×	×	×	×	○	○	○
50	Second output frequency detection	32	B2	0	○	○	○	○	○	○	○	○	○	○
51	Second electronic thermal O/L relay	33	B3	0	○	○	○	○	○	○	○	○	○	○
52	DU/PU main display data selection	34	B4	0	○	○	○	○	○	○	○	○	○	○
54	FM terminal function selection	36	B6	0	○	○	○	○	○	○	○	○	○	○
55	Frequency monitoring reference	37	B7	0	○	○	○	○	○	○	○	○	○	○
56	Current monitoring reference	38	B8	0	○	○	○	○	○	○	○	○	○	○
57	Restart coasting time	39	B9	0	○	○	○	○	×	○	○	○	○	○
58	Restart cushion time	3A	BA	0	○	○	×	×	×	×	×	○	○	○
59	Remote function selection	3B	BB	0	○	○	○	○	×	○	○	○	○	○
60	Energy saving control selection	3C	BC	0	○	×	×	×	×	×	×	○	○	○
61	Reference current	3D	BD	0	○	○	○	×	×	○	×	○	○	○
62	Reference value at acceleration	3E	BE	0	○	○	○	×	×	○	×	○	○	○
63	Reference value at dcceleration	3F	BF	0	○	○	○	×	×	○	×	○	○	○
64	Starting frequency for elevator mode	40	C0	0	○	×	×	×	×	×	×	○	○	○
65	Retry selection	41	C1	0	○	○	○	○	×	○	○	○	○	○
66	Stall prevention operation reduction starting frequency	42	C2	0	○	○	×	×	×	×	×	○	○	○
67	Number of retries at fault occurrence	43	C3	0	○	○	○	○	×	○	○	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
68	Retry waiting time	44	C4	0	○	○	○	○	×	○	○	○	○	○
69	Retry count display erase	45	C5	0	○	○	○	○	×	○	○	○	○	○
71	Applied motor	47	C7	0	○	○	○	○	○	○	○	○	○	○
72	PWM frequency selection	48	C8	0	○	○	○	○	○	○	○	○	○	○
73	Analog input selection	49	C9	0	○	○	○	○	×	○	○	○	○	○
74	Input filter time constant	4A	CA	0	○	○	○	○	×	○	○	○	○	○
75	Reset selection/ disconnected PU detection/ PU stop selection	4B	CB	0	○	○	○	○	○	○	○	○	×	×
76	Alarm code output selection	4C	CC	0	○	○	○	○	○	○	○	○	○	○
77 *	Parameter write selection	4D	CD	0	○	○	○	○	○	○	○	○	○	○
78	Reverse rotation prevention selection	4E	CE	0	○	○	○	○	○	○	○	○	○	○
79 *	Operation mode selection	4F	CF	0	○	○	○	○	○	○	○	○	○	○
80	Motor capacity	50	D0	0	×	○	○	○	○	○	○	○	○	○
81	Number of motor poles	51	D1	0	×	○	○	○	○	○	○	○	○	○
82	Motor excitation current	52	D2	0	×	○	○	○	○	○	○	○	×	○
83	Rated motor voltage	53	D3	0	×	○	○	○	○	○	○	○	○	○
84	Rated motor frequency	54	D4	0	×	○	○	○	○	○	○	○	○	○
89	Speed control gain (magnetic flux vector)	59	D9	0	×	○	×	×	×	×	×	○	×	○
90	Motor constant (R1)	5A	DA	0	×	○	○	○	○	○	○	○	×	○
91	Motor constant (R2)	5B	DB	0	×	○	○	○	○	○	○	○	×	○
92	Motor constant (L1)	5C	DC	0	×	○	○	○	○	○	○	○	×	○
93	Motor constant (L2)	5D	DD	0	×	○	○	○	○	○	○	○	×	○
94	Motor constant (X)	5E	DE	0	×	○	○	○	○	○	○	○	×	○
95	Online auto tuning selection	5F	DF	0	×	○	○	○	○	○	○	○	○	○
96	Auto tuning setting/status	60	E0	0	×	○	○	○	○	○	○	○	×	○
100	V/F1(first frequency)	00	80	1	○	×	×	×	×	×	×	○	○	○
101	V/F1(first frequency voltage)	01	81	1	○	×	×	×	×	×	×	○	○	○
102	V/F2(second frequency)	02	82	1	○	×	×	×	×	×	×	○	○	○
103	V/F2(second frequency voltage)	03	83	1	○	×	×	×	×	×	×	○	○	○
104	V/F3(third frequency)	04	84	1	○	×	×	×	×	×	×	○	○	○
105	V/F3(third frequency voltage)	05	85	1	○	×	×	×	×	×	×	○	○	○
106	V/F4(fourth frequency)	06	86	1	○	×	×	×	×	×	×	○	○	○
107	V/F4(fourth frequency voltage)	07	87	1	○	×	×	×	×	×	×	○	○	○
108	V/F5(fifth frequency)	08	88	1	○	×	×	×	×	×	×	○	○	○
109	V/F5(fifth frequency voltage)	09	89	1	○	×	×	×	×	×	×	○	○	○
110	Third acceleration/ deceleration time	0A	8A	1	○	○	○	○	Δ	○	○	○	○	○
111	Third deceleration time	0B	8B	1	○	○	○	○	Δ	○	○	○	○	○
112	Third torque boost	0C	8C	1	○	×	×	×	×	×	×	○	○	○
113	Third V/F (base frequency)	0D	8D	1	○	×	×	×	×	×	×	○	○	○
114	Third stall prevention operation current	0E	8E	1	○	○	×	×	×	×	×	○	○	○
115	Thrid stall prevention operation frequency	0F	8F	1	○	○	×	×	×	×	×	○	○	○

* Read and write from communication with PU connector only is enabled.

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
116	Third output frequency detection	10	90	1	○	○	○	○	○	○	○	○	○	○
117	PU communication station number	11	91	1	○	○	○	○	○	○	○	○	○*6	○*6
118	PU communication speed	12	92	1	○	○	○	○	○	○	○	○	○*6	○*6
119	PU communication stop bit length	13	93	1	○	○	○	○	○	○	○	○	○*6	○*6
120	PU communication parity check	14	94	1	○	○	○	○	○	○	○	○	○*6	○*6
121	Number of PU communication retries	15	95	1	○	○	○	○	○	○	○	○	○*6	○*6
122	PU communication check time interval	16	96	1	○	○	○	○	○	○	○	○	○*6	○*6
123	PU communication waiting time setting	17	97	1	○	○	○	○	○	○	○	○	○*6	○*6
124	PU communication CR/LF presence/absence selection	18	98	1	○	○	○	○	○	○	○	○	○*6	○*6
125	Terminal 2 frequency setting gain frequency	19	99	1	○	○	○	○	×	○	○	○	×	○
126	Terminal 4 frequency setting gain frequency	1A	9A	1	○	○	○	○	×	○	○	○	×	○
127	PID control automatic switchover frequency	1B	9B	1	○	○	○	×	×	○	×	○	○	○
128	PID action selection	1C	9C	1	○	○	○	×	×	○	×	○	○	○
129	PID proportional band	1D	9D	1	○	○	○	×	×	○	×	○	○	○
130	PID integral time	1E	9E	1	○	○	○	×	×	○	×	○	○	○
131	PID upper limit	1F	9F	1	○	○	○	×	×	○	×	○	○	○
132	PID lower limit	20	A0	1	○	○	○	×	×	○	×	○	○	○
133	PID action set point	21	A1	1	○	○	○	×	×	○	×	○	○	○
134	PID differential time	22	A2	1	○	○	○	×	×	○	×	○	○	○
135	Electronic bypass sequence selection	23	A3	1	○	○	○	×	×	○	×	○	○	○
136	MC switchover interlock time	24	A4	1	○	○	○	×	×	○	×	○	○	○
137	Start waiting time	25	A5	1	○	○	○	×	×	○	×	○	○	○
138	Bypass selection at a fault	26	A6	1	○	○	○	×	×	○	×	○	○	○
139	Automatic switchover frequency from inverter to bypass operation	27	A7	1	○	○	○	×	×	○	×	○	○	○
140	Backlash acceleration stopping frequency	28	A8	1	○	○	○	○	×	○	○	○	○	○
141	Backlash acceleration stopping time	29	A9	1	○	○	○	○	×	○	○	○	○	○
142	Backlash deceleration stopping frequency	2A	AA	1	○	○	○	○	×	○	○	○	○	○
143	Backlash deceleration stopping time	2B	AB	1	○	○	○	○	×	○	○	○	○	○
144	Speed setting switchover	2C	AC	1	○	○	○	○	○	○	○	○	○	○
145	PU display language selection	2D	AD	1	○	○	○	○	○	○	○	○	×	×
148	Stall prevention level at 0V input	30	B0	1	○	○	×	×	×	×	×	○	○	○
149	Stall prevention level at 10V input	31	B1	1	○	○	×	×	×	×	×	○	○	○
150	Output current detection level	32	B2	1	○	○	○	○	○	○	○	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
151	Output current detection signal delay time	33	B3	1	○	○	○	○	○	○	○	○	○	○
152	Zero current detection level	34	B4	1	○	○	○	○	○	○	○	○	○	○
153	Zero current detection time	35	B5	1	○	○	○	○	○	○	○	○	○	○
154	Voltage reduction selection during stall prevention operation	36	B6	1	○	○	×	×	×	×	×	○	○	○
155	RT signal function validity condition selection	37	B7	1	○	○	○	×	×	○	×	○	○	○
156	Stall prevention operation selection	38	B8	1	○	○	×	×	×	×	×	○	○	○
157	OL signal output timer	39	B9	1	○	○	○	○	○	○	○	○	○	○
158	AM terminal function selection	3A	BA	1	○	○	○	○	○	○	○	○	○	○
159	Automatic switchover frequency range from bypass to inverter operation	3B	BB	1	○	○	○	×	×	○	×	○	○	○
160	User group read selection	00	80	2	○	○	○	○	○	○	○	○	○	○
161	Frequency setting/key lock operation selection	01	81	2	○	○	○	○	○	○	○	○	×	○
162	Automatic restart after instantaneous power failure selection	02	82	2	○	○	○	○	×	○	○	○	○	○
163	First cushion time for restart	03	83	2	○	○	×	×	×	×	×	○	○	○
164	First cushion voltage for restart	04	84	2	○	○	×	×	×	×	×	○	○	○
165	Stall prevention operation level for restart	05	85	2	○	○	×	×	×	×	×	○	○	○
166	Output current detection signal retention time	06	86	2	○	○	○	○	○	○	○	○	○	○
167	Output current detection operation selection	07	87	2	○	○	○	○	○	○	○	○	○	○
168	Parameter for manufacturer setting. Do not set.													
169														
170	Watt-hour meter clear	0A	8A	2	○	○	○	○	○	○	○	○	×	○
171	Operation hour meter clear	0B	8B	2	○	○	○	○	○	○	○	×	×	×
172	User group registered display/batch clear	0C	8C	2	○	○	○	○	○	○	○	○	×	×
173	User group registration	0D	8D	2	○	○	○	○	○	○	○	×	×	×
174	User group clear	0E	8E	2	○	○	○	○	○	○	○	×	×	×
178	STF terminal function selection	12	92	2	○	○	○	○	○	○	○	○	×	○
179	STR terminal function selection	13	93	2	○	○	○	○	○	○	○	○	×	○
180	RL terminal function selection	14	94	2	○	○	○	○	○	○	○	○	×	○
181	RM terminal function selection	15	95	2	○	○	○	○	○	○	○	○	×	○
182	RH terminal function selection	16	96	2	○	○	○	○	○	○	○	○	×	○
183	RT terminal function selection	17	97	2	○	○	○	○	○	○	○	○	×	○
184	AU terminal function selection	18	98	2	○	○	○	○	○	○	○	○	×	○
185	JOG terminal function selection	19	99	2	○	○	○	○	○	○	○	○	×	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
186	CS terminal function selection	1A	9A	2	○	○	○	○	○	○	○	○	×	○
187	MRS terminal function selection	1B	9B	2	○	○	○	○	○	○	○	○	×	○
188	STOP terminal function selection	1C	9C	2	○	○	○	○	○	○	○	○	×	○
189	RES terminal function selection	1D	9D	2	○	○	○	○	○	○	○	○	×	○
190	RUN terminal function selection	1E	9E	2	○	○	○	○	○	○	○	○	×	○
191	SU terminal function selection	1F	9F	2	○	○	○	○	○	○	○	○	×	○
192	IPF terminal function selection	20	A0	2	○	○	○	○	○	○	○	○	×	○
193	OL terminal function selection	21	A1	2	○	○	○	○	○	○	○	○	×	○
194	FU terminal function selection	22	A2	2	○	○	○	○	○	○	○	○	×	○
195	ABC1 terminal function selection	23	A3	2	○	○	○	○	○	○	○	○	×	○
196	ABC2 terminal function selection	24	A4	2	○	○	○	○	○	○	○	○	×	○
232	Multi-speed setting (speed 8)	28	A8	2	○	○	○	○	Δ	○	○	○	○	○
233	Multi-speed setting (speed 9)	29	A9	2	○	○	○	○	Δ	○	○	○	○	○
234	Multi-speed setting (speed 10)	2A	AA	2	○	○	○	○	Δ	○	○	○	○	○
235	Multi-speed setting (speed 11)	2B	AB	2	○	○	○	○	Δ	○	○	○	○	○
236	Multi-speed setting (speed 12)	2C	AC	2	○	○	○	○	Δ	○	○	○	○	○
237	Multi-speed setting (speed 13)	2D	AD	2	○	○	○	○	Δ	○	○	○	○	○
238	Multi-speed setting (speed 14)	2E	AE	2	○	○	○	○	Δ	○	○	○	○	○
239	Multi-speed setting (speed 15)	2F	AF	2	○	○	○	○	Δ	○	○	○	○	○
240	Soft-PWM operation selection	30	B0	2	○	○	○	○	○	○	○	○	○	○
241	Analog input display unit switchover	31	B1	2	○	○	○	○	○	○	○	○	○	○
242	Terminal 1 added compensation amount (terminal 2)	32	B2	2	○	○	○	○	×	○	○	○	○	○
243	Terminal 1 added compensation amount (terminal 4)	33	B3	2	○	○	○	○	×	○	○	○	○	○
244	Cooling fan operation selection	34	B4	2	○	○	○	○	○	○	○	○	○	○
245	Rated slip	35	B5	2	○	×	×	×	×	×	×	○	○	○
246	Slip compensation time constant	36	B6	2	○	×	×	×	×	×	×	○	○	○
247	Constant-power region slip compensation selection	37	B7	2	○	×	×	×	×	×	×	○	○	○
250	Stop selection	3A	BA	2	○	○	○	○	×	○	○	○	○	○
251	Output phase loss protection selection	3B	BB	2	○	○	○	○	○	○	○	○	○	○
252	Override bias	3C	BC	2	○	○	○	○	×	○	○	○	○	○
253	Override gain	3D	BD	2	○	○	○	○	×	○	○	○	○	○
255	Life alarm status display	3F	BF	2	○	○	○	○	○	○	○	×	×	×
256	Inrush current limit circuit life display	40	C0	2	○	○	○	○	○	○	○	×	×	×

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
257	Control circuit capacitor life display	41	C1	2	○	○	○	○	○	○	○	×	×	×
258	Main circuit capacitor life display	42	C2	2	○	○	○	○	○	○	○	×	×	×
259	Main circuit capacitor life measuring	43	C3	2	○	○	○	○	○	○	○	○	○	○
261	Power failure stop selection	45	C5	2	○	○	○	○	×	○	○	○	○	○
262	Subtracted frequency at deceleration start	46	C6	2	○	○	○	○	×	○	○	○	○	○
263	Subtraction starting frequency	47	C7	2	○	○	○	○	×	○	○	○	○	○
264	Power-failure deceleration time 1	48	C8	2	○	○	○	○	×	○	○	○	○	○
265	Power-failure deceleration time 2	49	C9	2	○	○	○	○	×	○	○	○	○	○
266	Power failure deceleration time switchover frequency	4A	CA	2	○	○	○	○	×	○	○	○	○	○
267	Terminal 4 input selection	4B	CB	2	○	○	○	○	○	○	○	○	×	○
268	Monitor decimal digits selection	4C	CC	2	○	○	○	○	○	○	○	○	○	○
269	Parameter for manufacturer setting. Do not set.													
270	Stop-on contact/load torque high-speed frequency control selection	4E	CE	2	○	○	○	×	×	○	×	○	○	○
271	High-speed setting maximum current	4F	CF	2	○	○	○	×	×	○	×	○	○	○
272	Middle-speed setting minimum current	50	D0	2	○	○	○	×	×	○	×	○	○	○
273	Current averaging range	51	D1	2	○	○	○	×	×	○	×	○	○	○
274	Current averaging filter time constant	52	D2	2	○	○	○	×	×	○	×	○	○	○
275	Stop-on contact excitation current low-speed multiplying factor	53	D3	2	×	○	×	×	×	×	×	○	○	○
276	PWM carrier frequency at stop-on contact	54	D4	2	×	○	×	×	×	×	×	○	○	○
278	Brake opening frequency	56	D6	2	×	○	○	×	×	○	×	○	○	○
279	Brake opening current	57	D7	2	×	○	○	×	×	○	×	○	○	○
280	Brake opening current detection time	58	D8	2	×	○	○	×	×	○	×	○	○	○
281	Brake operation time at start	59	D9	2	×	○	○	×	×	○	×	○	○	○
282	Brake operation frequency	5A	DA	2	×	○	○	×	×	○	×	○	○	○
283	Brake operation time at stop	5B	DB	2	×	○	○	×	×	○	×	○	○	○
284	Deceleration detection function selection	5C	DC	2	○	○	○	×	×	×	×	○	○	○
285	Overspeed detection frequency (Speed deviation excess detection frequency)	5D	DD	2	○	○	○	×	×	○	×	○	○	○
286	Droop gain	5E	DE	2	×	○	○	×	×	○	×	○	○	○
287	Droop filter time constant	5F	DF	2	×	○	○	×	×	○	×	○	○	○
288	Droop function activation selection	60	E0	2	×	×	○	×	×	○	×	○	○	○
291	Pulse train I/O selection	63	E3	2	○	○	○	○	×	○	○	○	×	○
292	Automatic acceleration/ deceleration	64	E4	2	○	○	○	×	×	○	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
293	Acceleration/deceleration time individual calculation selection	65	E5	2	○	○	○	×	×	○	×	○	○	○
294	UV avoidance voltage gain	66	E6	2	○	○	○	○	×	○	○	○	○	○
296	Password lock level	68	E8	2	○	○	○	○	○	○	○	○	×	○
297	Password lock/unlock	69	E9	2	○	○	○	○	○	○	○	○	○*5	○
299	Rotation direction detection selection at restarting	6B	EB	2	○	○	×	×	×	○	×	○	○	○
300	BCD input bias AX	00	80	3	○	○	○	○	×	○	○	○	○	○
301	BCD input gain AX	01	81	3	○	○	○	○	×	○	○	○	○	○
302	BIN input bias AX	02	82	3	○	○	○	○	×	○	○	○	○	○
303	BIN input gain AX	03	83	3	○	○	○	○	×	○	○	○	○	○
304	Digital input and analog input compensation enable/ disable selection AX	04	84	3	○	○	○	○	×	○	○	○	○	○
305	Read timing operation selection AX	05	85	3	○	○	○	○	×	○	○	○	○	○
306	Analog output signal selection AY	06	86	3	○	○	○	○	○	○	○	○	○	○
307	Setting for zero analog output AY	07	87	3	○	○	○	○	○	○	○	○	○	○
308	Setting for maximum analog output AY	08	88	3	○	○	○	○	○	○	○	○	○	○
309	Analog output signal voltage/current switchover AY	09	89	3	○	○	○	○	○	○	○	○	○	○
310	Analog meter voltage output selection AY	0A	8A	3	○	○	○	○	○	○	○	○	○	○
311	Setting for zero analog meter voltage output AY	0B	8B	3	○	○	○	○	○	○	○	○	○	○
312	Setting for maximum analog meter voltage output AY	0C	8C	3	○	○	○	○	○	○	○	○	○	○
313	DO0 output selection AY NC	0D	8D	3	○	○	○	○	○	○	○	○	○	○
314	DO1 output selection AY NC	0E	8E	3	○	○	○	○	○	○	○	○	○	○
315	DO2 output selection AY NC	0F	8F	3	○	○	○	○	○	○	○	○	○	○
316	DO3 output selection AY	10	90	3	○	○	○	○	○	○	○	○	○	○
317	DO4 output selection AY	11	91	3	○	○	○	○	○	○	○	○	○	○
318	DO5 output selection AY	12	92	3	○	○	○	○	○	○	○	○	○	○
319	DO6 output selection AY	13	93	3	○	○	○	○	○	○	○	○	○	○
320	RA1 output selection AR	14	94	3	○	○	○	○	○	○	○	○	○	○
321	RA2 output selection AR	15	95	3	○	○	○	○	○	○	○	○	○	○
322	RA3 output selection AR	16	96	3	○	○	○	○	○	○	○	○	○	○
323	AM0 0V adjustment AY	17	97	3	○	○	○	○	○	○	○	○	×	○
324	AM1 0mA adjustment AY	18	98	3	○	○	○	○	○	○	○	○	×	○
329	Digital input increments selection AX	1D	9D	3	○	○	○	○	×	○	○	○	×	○
331	RS-485 communication station	1F	9F	3	○	○	○	○	○	○	○	○	○*6	○*6

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
332	RS-485 communication speed	20	A0	3	○	○	○	○	○	○	○	○	○*6	○*6
333	RS-485 communication stop bit length	21	A1	3	○	○	○	○	○	○	○	○	○*6	○*6
334	RS-485 communication parity check selection	22	A2	3	○	○	○	○	○	○	○	○	○*6	○*6
335	RS-485 communication retry count	23	A3	3	○	○	○	○	○	○	○	○	○*6	○*6
336	RS-485 communication check time interval	24	A4	3	○	○	○	○	○	○	○	○	○*6	○*6
337	RS-485 communication waiting time setting	25	A5	3	○	○	○	○	○	○	○	○	○*6	○*6
338	Communication operation command source	26	A6	3	○	○	○	○	○	○	○	○	○*6	○*6
339	Communication speed command source	27	A7	3	○	○	○	○	○	○	○	○	○*6	○*6
340	Communication startup mode selection	28	A8	3	○	○	○	○	○	○	○	○	○*6	○*6
341	RS-485 communication CR/LF selection	29	A9	3	○	○	○	○	○	○	○	○	○*6	○*6
342	Communication EEPROM write selection	2A	AA	3	○	○	○	○	○	○	○	○	○	○
343	Communication error count	2B	AB	3	○	○	○	○	○	○	○	×	×	×
345	DeviceNet address ND	2D	AD	3	○	○	○	○	○	○	○	○	○*6	○*6
346	DeviceNet baud rate ND	2E	AE	3	○	○	○	○	○	○	○	○	○*6	○*6
349	Communication reset selection NC ND NL NP	31	B1	3	○	○	○	○	○	○	○	○	○*6	○*6
350	Stop position command selection AP AL	32	B2	3	○	○	○	×	×	×	×	○	○	○
351	Orientation speed AP AL	33	B3	3	○	○	○	×	×	×	×	○	○	○
352	Creep speed AP AL	34	B4	3	○	○	○	×	×	×	×	○	○	○
353	Creep switchover position AP AL	35	B5	3	○	○	○	×	×	×	×	○	○	○
354	Position loop switchover position AP AL	36	B6	3	○	○	○	×	×	×	×	○	○	○
355	DC injection brake start position AP AL	37	B7	3	○	○	○	×	×	×	×	○	○	○
356	Internal stop position command AP AL	38	B8	3	○	○	○	×	×	×	×	○	○	○
357	Orientation in-position zone AP AL	39	B9	3	○	○	○	×	×	×	×	○	○	○
358	Servo torque selection AP AL	3A	BA	3	○	○	○	×	×	×	×	○	○	○
359	Encoder rotation direction AP AL	3B	BB	3	○	○	○	○	○	×	×	○	○	○
360	16 bit data selection AP AL	3C	BC	3	○	○	○	×	×	×	×	○	○	○
361	Position shift AP AL	3D	BD	3	○	○	○	×	×	×	×	○	○	○
362	Orientation position loop gain AP AL	3E	BE	3	○	○	○	×	×	×	×	○	○	○
363	Completion signal output delay time AP AL	3F	BF	3	○	○	○	×	×	×	×	○	○	○
364	Encoder stop check time AP AL	40	C0	3	○	○	○	×	×	×	×	○	○	○
365	Orientation limit AP AL	41	C1	3	○	○	○	×	×	×	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
366	Recheck time AP AL	42	C2	3	○	○	○	×	×	×	×	○	○	○
367	Speed feedback range AP AL	43	C3	3	○	○	○	×	×	×	×	○	○	○
368	Feedback gain AP AL	44	C4	3	○	○	×	×	×	×	×	○	○	○
369	Number of encoder pulses AP AL	45	C5	3	○	○	○	○	○	×	×	○	○	○
374	Overspeed detection level	4A	CA	3	×	×	○	○	○	○	○	○	○	○
376	Encoder signal loss detection enable/disable selection AP AL	4C	CC	3	○	○	○	○	○	×	×	○	○	○
379	SSCNET III rotation direction selection NS	4F	CF	3	×	×	○	○	○	×	×	○	○	○
380	Acceleration S-pattern 1	50	D0	3	○	○	○	○	×	○	○	○	○	○
381	Deceleration S-pattern 1	51	D1	3	○	○	○	○	×	○	○	○	○	○
382	Acceleration S-pattern 2	52	D2	3	○	○	○	○	×	○	○	○	○	○
383	Deceleration S-pattern 2	53	D3	3	○	○	○	○	×	○	○	○	○	○
384	Input pulse division scaling factor	54	D4	3	○	○	○	○	×	○	○	○	○	○
385	Frequency for 0 input pulse	55	D5	3	○	○	○	○	×	○	○	○	○	○
386	Frequency for maximum input pulse	56	D6	3	○	○	○	○	×	○	○	○	○	○
387	Initial communication delay time NL	57	D7	3	○	○	○	○	○	○	○	○	○	○
388	Send time interval at heart beat NL	58	D8	3	○	○	○	○	○	○	○	○	○	○
389	Minimum sending time at heart beat NL	59	D9	3	○	○	○	○	○	○	○	○	○	○
390	% setting reference frequency NL	5A	DA	3	○	○	○	○	○	○	○	○	○	○
391	Receive time interval at heart beat NL	5B	DB	3	○	○	○	○	○	○	○	○	○	○
392	Event driven detection width NL	5C	DC	3	○	○	○	○	○	○	○	○	○	○
393	Orientation selection AP AL	5D	DD	3	×	×	○	×	×	×	×	○	○	○
396	Orientation speed gain (P term) AP AL	60	E0	3	×	×	○	×	×	×	×	○	○	○
397	Orientation speed integral time AP AL	61	E1	3	×	×	○	×	×	×	×	○	○	○
398	Orientation speed gain (D term) AP AL	62	E2	3	×	×	○	×	×	×	×	○	○	○
399	Orientation deceleration ratio AP AL	63	E3	3	×	×	○	×	×	×	×	○	○	○
406	High resolution analog input selection AZ	06	86	4	○	○	○	○	○	○	○	○	×	○
407	Motor temperature detection filter AZ	07	87	4	○	○	○	○	○	○	○	○	○	○
408	Motor thermistor selection AZ	08	88	4	○	○	○	○	○	○	○	○	○	○
413	Encoder pulse division ratio AL	0D	8D	4	○	○	○	○	○	○	○	○	○	○
419	Position command source selection AP AL	13	93	4	×	×	×	×	○	×	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
420	Command pulse scaling factor numerator AP AL	14	94	4	×	×	×	×	○	×	×	○	○	○
421	Command pulse scaling factor denominator AP AL	15	95	4	×	×	×	×	○	×	×	○	○	○
422	Position loop gain AP AL	16	96	4	×	×	×	×	○	×	×	○	○	○
423	Position feed forward gain AP AL	17	97	4	×	×	×	×	○	×	×	○	○	○
424	Position command acceleration/deceleration time constant AP AL	18	98	4	×	×	×	×	○	×	×	○	○	○
425	Position feed forward command filter AP AL	19	99	4	×	×	×	×	○	×	×	○	○	○
426	In-position width AP AL	1A	9A	4	×	×	×	×	○	×	×	○	○	○
427	Excessive level error AP AL	1B	9B	4	×	×	×	×	○	×	×	○	○	○
428	Command pulse selection AP AL	1C	9C	4	×	×	×	×	○	×	×	○	○	○
429	Clear signal selection AP AL	1D	9D	4	×	×	×	×	○	×	×	○	○	○
430	Pulse monitor selection AP AL	1E	9E	4	×	×	×	×	○	×	×	○	○	○
432	Pulse train torque command bias AL	20	A0	4	×	×	×	○	×	×	○	○	○	○
433	Pulse train torque command gain AL	21	A1	4	×	×	×	○	×	×	○	○	○	○
447	Digital torque command bias AX	2F	AF	4	×	×	×	○	×	×	○	○	○	○
448	Digital torque command gain AX	30	B0	4	×	×	×	○	×	×	○	○	○	○
449	SSCNET III input filter setting NS	31	B1	4	×	×	○	○	○	×	×	○	○	○
450	Second applied motor	32	B2	4	○	○	×	×	×	○	○	○	○	○
451	Second motor control method selection	33	B3	4	○	○	×	×	×	○	○	○	○	○
453	Second motor capacity	35	B5	4	×	○	×	×	×	○	○	○	○	○
454	Number of second motor poles	36	B6	4	×	○	×	×	×	○	○	○	○	○
455	Second motor excitation current	37	B7	4	×	○	×	×	×	○	○	○	×	○
456	Rated second motor voltage	38	B8	4	×	○	×	×	×	○	○	○	○	○
457	Rated second motor frequency	39	B9	4	×	○	×	×	×	○	○	○	○	○
458	Second motor constant (R1)	3A	BA	4	×	○	×	×	×	○	○	○	×	○
459	Second motor constant (R2)	3B	BB	4	×	○	×	×	×	○	○	○	×	○
460	Second motor constant (L1)	3C	BC	4	×	○	×	×	×	○	○	○	×	○
461	Second motor constant (L2)	3D	BD	4	×	○	×	×	×	○	○	○	×	○
462	Second motor constant (X)	3E	BE	4	×	○	×	×	×	○	○	○	×	○
463	Second motor auto tuning setting/status	3F	BF	4	×	○	×	×	×	○	○	○	×	○
464	Digital position control sudden stop deceleration time AP AL	40	C0	4	×	×	×	×	○	×	×	○	○	○
465	First position feed amount lower 4 digits AP AL	41	C1	4	×	×	×	×	○	×	×	○	○	○
466	First position feed amount upper 4 digits AP AL	42	C2	4	×	×	×	×	○	×	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
467	Second position feed amount lower 4 digits AP AL	43	C3	4	×	×	×	×	○	×	×	○	○	○
468	Second position feed amount upper 4 digits AP AL	44	C4	4	×	×	×	×	○	×	×	○	○	○
469	Third position feed amount lower 4 digits AP AL	45	C5	4	×	×	×	×	○	×	×	○	○	○
470	Third position feed amount upper 4 digits AP AL	46	C6	4	×	×	×	×	○	×	×	○	○	○
471	Fourth position feed amount lower 4 digits AP AL	47	C7	4	×	×	×	×	○	×	×	○	○	○
472	Fourth position feed amount upper 4 digits AP AL	48	C8	4	×	×	×	×	○	×	×	○	○	○
473	Fifth position feed amount lower 4 digits AP AL	49	C9	4	×	×	×	×	○	×	×	○	○	○
474	Fifth position feed amount upper 4 digits AP AL	4A	CA	4	×	×	×	×	○	×	×	○	○	○
475	Sixth position feed amount lower 4 digits AP AL	4B	CB	4	×	×	×	×	○	×	×	○	○	○
476	Sixth position feed amount upper 4 digits AP AL	4C	CC	4	×	×	×	×	○	×	×	○	○	○
477	Seventh position feed amount lower 4 digits AP AL	4D	CD	4	×	×	×	×	○	×	×	○	○	○
478	Seventh position feed amount upper 4 digits AP AL	4E	CE	4	×	×	×	×	○	×	×	○	○	○
479	Eighth position feed amount lower 4 digits AP AL	4F	CF	4	×	×	×	×	○	×	×	○	○	○
480	Eighth position feed amount upper 4 digits AP AL	50	D0	4	×	×	×	×	○	×	×	○	○	○
481	Ninth position feed amount lower 4 digits AP AL	51	D1	4	×	×	×	×	○	×	×	○	○	○
482	Ninth position feed amount upper 4 digits AP AL	52	D2	4	×	×	×	×	○	×	×	○	○	○
483	Tenth position feed amount lower 4 digits AP AL	53	D3	4	×	×	×	×	○	×	×	○	○	○
484	Tenth position feed amount upper 4 digits AP AL	54	D4	4	×	×	×	×	○	×	×	○	○	○
485	Eleventh position feed amount lower 4 digits AP AL	55	D5	4	×	×	×	×	○	×	×	○	○	○
486	Eleventh position feed amount upper 4 digits AP AL	56	D6	4	×	×	×	×	○	×	×	○	○	○
487	Twelfth position feed amount lower 4 digits AP AL	57	D7	4	×	×	×	×	○	×	×	○	○	○
488	Twelfth position feed amount upper 4 digits AP AL	58	D8	4	×	×	×	×	○	×	×	○	○	○
489	Thirteenth position feed amount lower 4 digits AP AL	59	D9	4	×	×	×	×	○	×	×	○	○	○
490	Thirteenth position feed amount upper 4 digits AP AL	5A	DA	4	×	×	×	×	○	×	×	○	○	○
491	Fourteenth position feed amount lower 4 digits AP AL	5B	DB	4	×	×	×	×	○	×	×	○	○	○
492	Fourteenth position feed amount upper 4 digits AP AL	5C	DC	4	×	×	×	×	○	×	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
493	Fifteenth position feed amount lower 4 digits AP AL	5D	DD	4	×	×	×	×	○	×	×	○	○	○
494	Fifteenth position feed amount upper 4 digits AP AL	5E	DE	4	×	×	×	×	○	×	×	○	○	○
495	Remote output selection	5F	DF	4	○	○	○	○	○	○	○	○	○	○
496	Remote output data 1	60	E0	4	○	○	○	○	○	○	○	×	×	×
497	Remote output data 2	61	E1	4	○	○	○	○	○	○	○	×	×	×
499	SSCNET III operation selection NS	63	E3	4	×	×	○	○	○	×	×	○	○	○
500	Communication error execution waiting time NC ND NL NP	00	80	5	○	○	○	○	○	○	○	○	○	○
501	Communication error occurrence count display NC ND NL NP	01	81	5	○	○	○	○	○	○	○	×	○	○
502	Stop mode selection at communication error NC ND NL NP	02	82	5	○	○	○	○	○	○	○	○	○	○
503	Maintenance timer	03	83	5	○	○	○	○	○	○	○	×	×	×
504	Maintenance timer alarm output set time	04	84	5	○	○	○	○	○	○	○	○	×	○
505	Speed setting reference	05	85	5	○	○	○	○	○	○	○	○	○	○
516	S-pattern time at a start of acceleration	10	90	5	○	○	○	○	×	○	○	○	○	○
517	S-pattern time at a completion of acceleration	11	91	5	○	○	○	○	×	○	○	○	○	○
518	S-pattern time at a start of deceleration	12	92	5	○	○	○	○	×	○	○	○	○	○
519	S-pattern time at a completion of deceleration	13	93	5	○	○	○	○	×	○	○	○	○	○
539	Modbus-RTU communication check time interval	27	A7	5	○	○	○	○	○	○	○	○	○*6	○*6
541	Frequency command sign selection (CC-Link) NC	29	A9	5	○	○	○	×	×	○	×	○	○*6	○*6
542	Communication station number (CC-Link) NC	2A	AA	5	○	○	○	○	○	○	○	○	○*6	○*6
543	Baud rate (CC-Link) NC	2B	AB	5	○	○	○	○	○	○	○	○	○*6	○*6
544	CC-Link extended setting NC	2C	AC	5	○	○	○	○	○	○	○	○	○*6	○*6
547	USB communication station number	2F	AF	5	○	○	○	○	○	○	○	○	○*6	○*6
548	USB communication check time interval	30	B0	5	○	○	○	○	○	○	○	○	○*6	○*6
549	Protocol selection	31	B1	5	○	○	○	○	○	○	○	○	○*6	○*6
550	NET mode operation command source selection	32	B2	5	○	○	○	○	○	○	○	○	○*6	○*6
551	PU mode operation command source selection	33	B3	5	○	○	○	○	○	○	○	○	○*6	○*6
555	Current average time	37	B7	5	○	○	○	○	○	○	○	○	○	○
556	Data output mask time	38	B8	5	○	○	○	○	○	○	○	○	○	○
557	Current average value monitor signal output reference current	39	B9	5	○	○	○	○	○	○	○	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
563	Energization time carrying-over times	3F	BF	5	○	○	○	○	○	○	○	×	×	×
564	Operating time carrying-over times	40	C0	5	○	○	○	○	○	○	○	×	×	×
569	Second motor speed control gain	45	C5	5	×	○	×	×	×	×	×	○	×	○
571	Holding time at a start	47	C7	5	○	○	○	○	×	○	○	○	○	○
574	Second motor online auto tuning	4A	CA	5	×	○	×	×	×	○	○	○	○	○
575	Output interruption detection time	4B	CB	5	○	○	○	×	×	○	×	○	○	○
576	Output interruption detection level	4C	CC	5	○	○	○	×	×	○	×	○	○	○
577	Output interruption cancel level	4D	CD	5	○	○	○	×	×	○	×	○	○	○
611	Acceleration time at a restart	0B	8B	6	○	○	○	×	×	○	×	○	○	○
665	Regeneration avoidance frequency gain	41	C1	6	○	○	○	×	×	○	×	○	○	○
684	Tuning data increments switchover	54	D4	6	×	○	○	○	○	○	○	○	○	○
800	Control method selection	00	80	8	○	○	○	○	○	○	○	○	○	○
802	Pre-excitation selection AP AL	02	82	8	×	×	○	×	×	×	×	○	○	○
803	Constant power range torque characteristic selection	03	83	8	×	×	○	○	○	○	○	○	○	○
804	Torque command source selection	04	84	8	×	×	×	○	×	×	○	○	○	○
805	Torque command value (RAM)	05	85	8	×	×	×	○	×	×	○	×	○	○
806	Torque command value (RAM,EEPROM)	06	86	8	×	×	×	○	×	×	○	○	○	○
807	Speed limit selection	07	87	8	×	×	×	○	×	×	○	○	○	○
808	Forward rotation speed limit	08	88	8	×	×	×	○	×	×	○	○	○	○
809	Reverse rotation speed limit	09	89	8	×	×	×	○	×	×	○	○	○	○
810	Torque limit input method selection	0A	8A	8	×	×	○	×	○	○	×	○	○	○
811	Set resolution switchover	0B	8B	8	○	○	○	○	○	○	○	○	○	○
812	Torque limit level (regeneration)	0C	8C	8	×	×	○	×	○	○	×	○	○	○
813	Torque limit level (3rd quadrant)	0D	8D	8	×	×	○	×	○	○	×	○	○	○
814	Torque limit level (4th quadrant)	0E	8E	8	×	×	○	×	○	○	×	○	○	○
815	Torque limit level 2	0F	8F	8	×	×	○	×	○	○	×	○	○	○
816	Torque limit level during acceleration	10	90	8	×	×	○	×	○	○	×	○	○	○
817	Torque limit level during deceleration	11	91	8	×	×	○	×	○	○	×	○	○	○
818	Easy gain tuning response level setting	12	92	8	×	×	○	×	○	○	×	○	○	○
819	Easy gain tuning selection	13	93	8	×	×	○	×	○	○	×	○	×	○
820	Speed control P gain 1	14	94	8	×	×	○	×	○	○	×	○	○	○
821	Speed control integral time 1	15	95	8	×	×	○	×	○	○	×	○	○	○
822	Speed setting filter 1	16	96	8	×	×	○	○	×	○	○	○	○	○
823	Speed detection filter 1 AP AL	17	97	8	×	×	○	○	○	×	×	○	○	○
824	Torque control P gain 1	18	98	8	×	×	○	○	○	○	○	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
825	Torque control integral time 1	19	99	8	×	×	○	○	○	○	○	○	○	○
826	Torque setting filter 1	1A	9A	8	×	×	○	○	○	○	○	○	○	○
827	Torque detection filter 1	1B	9B	8	×	×	○	○	○	○	○	○	○	○
828	Model speed control gain	1C	9C	8	×	×	○	×	○	○	×	○	○	○
829	Number of machine end encoder pulses AL	1D	9D	8	○	○	○	×	×	×	×	○	○	○
830	Speed control P gain 2	1E	9E	8	×	×	○	×	○	○	×	○	○	○
831	Speed control integral time 2	1F	9F	8	×	×	○	×	○	○	×	○	○	○
832	Speed setting filter2	20	A0	8	×	×	○	○	×	○	○	○	○	○
833	Speed detection filter 2 AP AL	21	A1	8	×	×	○	×	○	×	×	○	○	○
834	Torque control P gain 2	22	A2	8	×	×	○	○	○	○	○	○	○	○
835	Torque control integral time 2	23	A3	8	×	×	○	○	○	○	○	○	○	○
836	Torque setting filter2	24	A4	8	×	×	○	○	○	○	○	○	○	○
837	Torque detection filter 2	25	A5	8	×	×	○	○	○	○	○	○	○	○
838	DA1 terminal function selection AZ	26	A6	8	○	○	○	○	○	○	○	○	○	○
839	DA1 output filter AZ	27	A7	8	○	○	○	○	○	○	○	○	○	○
840	Torque bias selection AP AL	28	A8	8	×	×	○	×	×	×	×	○	○	○
841	Torque bias 1 AP AL	29	A9	8	×	×	○	×	×	×	×	○	○	○
842	Torque bias 2 AP AL	2A	AA	8	×	×	○	×	×	×	×	○	○	○
843	Torque bias 3 AP AL	2B	AB	8	×	×	○	×	×	×	×	○	○	○
844	Torque bias filter AP AL	2C	AC	8	×	×	○	×	×	×	×	○	○	○
845	Torque bias operation time AP AL	2D	AD	8	×	×	○	×	×	×	×	○	○	○
846	Torque bias balance compensation AP AL	2E	AE	8	×	×	○	×	×	×	×	○	○	○
847	Fall-time torque bias terminal 1 bias AP AL	2F	AF	8	×	×	○	×	×	×	×	○	○	○
848	Fall-time torque bias terminal 1 gain AP AL	30	B0	8	×	×	○	×	×	×	×	○	○	○
849	Analog input off set adjustment	31	B1	8	○	○	○	○	○	○	○	○	○	○
850	Control operation selection	32	B2	8	×	×	×	×	×	○	○	○	○	○
853	Speed deviation time AP AL	35	B5	8	×	×	○	×	×	×	×	○	○	○
854	Excitation ratio	36	B6	8	×	×	○	○	○	○	○	○	○	○
857	DA1-0V adjustment AZ	39	B9	8	○	○	○	○	○	○	○	○	×	○
858	Terminal 4 function assignment	3A	BA	8	○	○	○	○	○	○	○	○	×	○
859	Torque current	3B	BB	8	×	○	○	○	○	○	○	○	×	○
860	Second motor torque current	3C	BC	8	×	○	×	×	×	○	○	○	×	○
862	Notch filter time constant	3E	BE	8	×	×	○	×	○	○	×	○	○	○
863	Notch filter depth	3F	BF	8	×	×	○	×	○	○	×	○	○	○
864	Torque detection	40	C0	8	×	×	○	○	○	○	○	○	○	○
865	Low speed detection	41	C1	8	×	×	○	○	○	○	○	○	○	○
866	Torque monitoring reference	42	C2	8	×	○	○	○	○	○	○	○	○	○
867	AM output filter	43	C3	8	○	○	○	○	○	○	○	○	○	○
868	Terminal 1 function assignment	44	C4	8	○	○	○	○	○	○	○	○	×	○
872	Input phase failure protection selection	48	C8	8	○	○	○	○	○	○	○	○	○	○
873	Speed limit AP AL	49	C9	8	×	×	○	×	×	×	×	○	○	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
874	OLT level setting	4A	CA	8	×	×	○	×	○	○	×	○	○	○
875	Fault definition	4B	CB	8	○	○	○	○	×	○	○	○	○	○
877	Speed feed forward control/ model adaptive speed control selection	4D	CD	8	×	×	○	×	○	○	×	○	○	○
878	Speed feed forward filter	4E	CE	8	×	×	○	×	○	○	×	○	○	○
879	Speed feed forward torque limit	4F	CF	8	×	×	○	×	○	○	×	○	○	○
880	Load inertia ratio	50	D0	8	×	×	○	×	○	○	×	○	×	○
881	Speed feed forward gain	51	D1	8	×	×	○	×	○	○	×	○	○	○
882	Regeneration avoidance operation selection	52	D2	8	○	○	○	×	×	○	×	○	○	○
883	Regeneration avoidance operation level	53	D3	8	○	○	○	×	×	○	×	○	○	○
884	Regeneration avoidance at deceleration detection sensitivity	54	D4	8	○	○	○	×	×	○	×	○	○	○
885	Regeneration avoidance compensation frequency limit value	55	D5	8	○	○	○	×	×	○	×	○	○	○
886	Regeneration avoidance voltage gain	56	D6	8	○	○	○	×	×	○	×	○	○	○
888	Free parameter 1	58	D8	8	○	○	○	○	○	○	○	○	×	×
889	Free parameter 2	59	D9	8	○	○	○	○	○	○	○	○	×	×
891	Cumulative power monitor digit shifted times	5B	DB	8	○	○	○	○	○	○	○	○	○	○
892	Load factor	5C	DC	8	○	○	○	○	○	○	○	○	○	○
893	Energy saving monitor reference (motor capacity)	5D	DD	8	○	○	○	○	○	○	○	○	○	○
894	Control selection during commercial power supply operation	5E	DE	8	○	○	○	○	○	○	○	○	○	○
895	Power saving rate reference value	5F	DF	8	○	○	○	○	○	○	○	○	○	○
896	Power unit cost	60	E0	8	○	○	○	○	○	○	○	○	○	○
897	Power saving monitor average time	61	E1	8	○	○	○	○	○	○	○	○	○	○
898	Power saving cumulative monitor clear	62	E2	8	○	○	○	○	○	○	○	○	×	○
899	Operation time rate (estimated value)	63	E3	8	○	○	○	○	○	○	○	○	○	○
C0 (900)	FM terminal calibration	5C	DC	1	○	○	○	○	○	○	○	○	×	○
C1 (901)	AM terminal calibration	5D	DD	1	○	○	○	○	○	○	○	○	×	○
C2 (902)	Terminal 2 frequency setting bias frequency	5E	DE	1	○	○	○	○	○	○	○	○	×	○
C3 (902)	Terminal 2 frequency setting bias	5E	DE	1	○	○	○	○	○	○	○	○	×	○
125 (903)	Terminal 2 frequency setting gain frequency	5F	DF	1	○	○	○	○	○	○	○	○	×	○
C4 (903)	Terminal 2 frequency setting gain	5F	DF	1	○	○	○	○	○	○	○	○	×	○
C5 (904)	Terminal 4 frequency setting bias frequency	60	E0	1	○	○	○	○	○	○	○	○	×	○

Parameter	Name	Instruction Code *1			Control Mode-based Correspondence Table *2							Parameter Copy *3	Parameter Clear *3	All Parameter Clear *3
		Read	Write	Extended	V/F Control	Advanced magnetic flux vector control	Vector control			Real sensorless vector control				
							Speed control	Torque control	Position control	Speed control	Torque control			
C6 (904)	Terminal 4 frequency setting bias	60	E0	1	○	○	○	○	○	○	○	○	×	○
126 (905)	Terminal 4 frequency setting gain frequency	61	E1	1	○	○	○	○	○	○	○	○	×	○
C7 (905)	Terminal 4 frequency setting gain	61	E1	1	○	○	○	○	○	○	○	○	×	○
C12 (917)	Terminal 1 bias frequency (speed)	11	91	9	×	×	○	○	○	○	○	○	×	○
C13 (917)	Terminal 1 bias frequency (speed)	11	91	9	×	×	○	○	○	○	○	○	×	○
C14 (918)	Terminal 1 gain frequency (speed)	12	92	9	×	×	○	○	○	○	○	○	×	○
C15 (918)	Terminal 1 gain (speed)	12	92	9	×	×	○	○	○	○	○	○	×	○
C16 (919)	Terminal 1 bias command (torque/magnetic flux)	13	93	9	×	×	○	○	○	○	○	○	×	○
C17 (919)	Terminal 1 bias (torque/ magnetic flux)	13	93	9	×	×	○	○	○	○	○	○	×	○
C18 (920)	Terminal 1 gain command (torque/magnetic flux)	14	94	9	×	×	○	○	○	○	○	○	×	○
C19 (920)	Terminal 1 gain (torque/ magnetic flux)	14	94	9	×	×	○	○	○	○	○	○	×	○
C29 (925)	Motor temperature detection calibration (analog input) AZ	19	99	9	○	○	○	○	○	○	○	○	×	○
C30 (926)	Terminal 6 bias frequency (speed) AZ	1A	9A	9	○	○	○	○	○	○	○	○	×	○
C31 (926)	Terminal 6 bias (speed) AZ	1A	9A	9	○	○	○	○	○	○	○	○	×	○
C32 (927)	Terminal 6 gain frequency (speed) AZ	1B	9B	9	○	○	○	○	○	○	○	○	×	○
C33 (927)	Terminal 6 gain (speed) AZ	1B	9B	9	○	○	○	○	○	○	○	○	×	○
C34 (928)	Terminal 6 bias command (torque) AZ	1C	9C	9	×	×	○	○	○	○	○	○	×	○
C35 (928)	Terminal 6 bias (torque) AZ	1C	9C	9	×	×	○	○	○	○	○	○	×	○
C36 (929)	Terminal 6 gain command (torque) AZ	1D	9D	9	×	×	○	○	○	○	○	○	×	○
C37 (929)	Terminal 6 gain (torque) AZ	1D	9D	9	×	×	○	○	○	○	○	○	×	○
C38 (932)	Terminal 4 bias command (torque/magnetic flux)	20	A0	9	×	×	○	○	○	○	○	○	×	○
C39 (932)	Terminal 4 bias (torque/ magnetic flux)	20	A0	9	×	×	○	○	○	○	○	○	×	○
C40 (933)	Terminal 4 gain command (torque/magnetic flux)	21	A1	9	×	×	○	○	○	○	○	○	×	○
C41 (933)	Terminal 4 gain (torque/ magnetic flux)	21	A1	9	×	×	○	○	○	○	○	○	×	○
989	Parameter for manufacturer setting. Do not set.													
990	PU buzzer control	5A	DA	9	○	○	○	○	○	○	○	○	○	○
991	PU contrast adjustment	5B	DB	9	○	○	○	○	○	○	○	○	×	○

REVISIONS

*The manual number is given on the bottom left of the back cover.

Print Date	*Manual Number	Revision
Aug. 2007	IB(NA)-0600331ENG-A	First edition
Apr. 2008	IB(NA)-0600331ENG-B	Addition · FR-A721-18.5K to 55K
Apr. 2008	IB(NA)-0600331ENG-C	Addition · FR-A741-5.5K to 15K
Jul. 2008	IB(NA)-0600331ENG-D	Addition · FR-A741-18.5K to 55K
Dec. 2010	IB(NA)-0600331ENG-E	Addition · Setting values "65, 66" for *Pr. 52 DU/PU main display data selection* · Setting value "2" for *Pr. 170 Watt-hour meter clear* · *Pr. 296 Password lock level* · *Pr. 297 Password lock/unlock* · Setting value "2" for *Pr. 850 Brake operation selection* · Password locked (LOCD) · Compatibility with FR-A7AL Modification · Appendix 2 Instructions for compliance with the EU Directives (400V class only) · Option fault (E.OPT)

⚠ For Maximum Safety

- Mitsubishi inverters are not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to prevent serious accidents when it is used in facilities where breakdowns of the product are likely to cause a serious accident.
- Please do not use this product for loads other than three-phase induction motors.

FR-V500, A700, A701 Series
Instruction Manual Supplement

When installing a thermal relay to the cooling fan of the vector-control dedicated motors (SF-V5RU), use the following recommended thermal relay settings.

●200V class (Mitsubishi dedicated motor [SF-V5RU (1500r/min series)])

Motor type SF-V5RU□□K		1	2	3	5	7	11	15	18	22	30	37	45	55
Cooling fan (with thermal protector)*2*3	Voltage	Single-phase 200V/50Hz Single-phase 200V to 230V/60Hz					Three-phase 200V/50Hz Three-phase 200 to 230V/60Hz							
	Input *1	36/55W (0.26/0.32A)			22/28W (0.11/0.13A)		55/71W (0.37/0.39A)				100/156W (0.47/0.53A)			85/130W (0.46/0.52A)
	Thermal relay settings	0.36A			0.18A		0.51A				0.69A			0.68A

●400V class (Mitsubishi dedicated motor [SF-V5RUH (1500r/min series)])

Motor type SF-V5RUH□□K		1	2	3	5	7	11	15	18	22	30	37	45	55
Cooling fan (with thermal protector)*2*3	Voltage	Single-phase 200V/50Hz Single-phase 200V to 230V/60Hz					Three-phase 380 to 400V/50Hz Three-phase 400 to 460V/60Hz							
	Input *1	36/55W (0.26/0.32A)			22/28W (0.11/0.13A)		55/71W (0.19/0.19A)				100/156W (0.27/0.30A)			85/130W (0.23/0.26A)
	Thermal relay settings	0.36A			0.18A		0.25A				0.39A			0.34A

*1 Power (current) at 50Hz/60Hz.

*2 The cooling fan is equipped with a thermal protector. The cooling fan stops when the coil temperature exceeds the specified value in order to protect the fan motor. A restrained cooling fan or degraded fan motor insulation may causes the rise in coil temperature. The fan motor re-starts when the coil temperature drops to normal.

*3 The voltage and input values are the standard specifications of the cooling fan in free air. When the cooling fan is used with a motor, it requires more energy to perform its work, and thus the above input values become slightly larger. The cooling fan can, however, be used as it is without causing problems. When a thermal relay is to be prepared at the customer's side, use the recommended thermal relay settings.

BCN-C22005-642

FR-A701 Series
Instruction Manual Supplement

For the FR-A701 series manufactured in September 2013 or later, the following specifications are added. Check the serial number printed on the rating plate of the inverter. (For how to find the SERIAL number, *refer to page 4.*)

● Brake sequence function *(Pr.278 to Pr.285, Pr.292)*

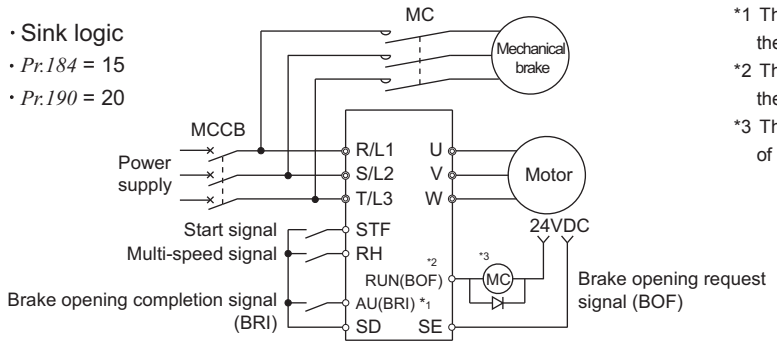
When the brake sequence mode 1 or 2 (*Pr.292* = "17 or 18") is selected, the brake sequence remains active even if the RT signal or X9 signal is turned ON to select the second or third function.

Parameter Number	Name	Initial Value	Setting Range	Description	
278	Brake opening frequency	3Hz	0 to 30Hz	Set to the rated slip frequency of the motor + about 1.0Hz. This parameter may be only set if *Pr.278* ≤ *Pr.282*.	
279	Brake opening current	130%	0 to 220%	Generally, set this parameter to about 50 to 90%. If the setting is too low, the load is liable to drop due to gravity at start. Suppose that the rated inverter current is 100%.	
280	Brake opening current detection time	0.3s	0 to 2s	Generally, set this parameter to about 0.1 to 0.3s.	
281	Brake operation time at start	0.3s	0 to 5s	Set the mechanical delay time until the brake is loosened when *Pr.292* = "7 or 17". Set the mechanical delay time until the brake is loosened + about 0.1 to 0.2s when *Pr.292* = "8 or 18".	
282	Brake operation frequency	6Hz	0 to 30Hz	Set the frequency to activate the mechanical brake by turning off the brake opening request signal (BOF). Generally, set this parameter to the *Pr.278* setting + 3 to 4Hz. Setting is enabled only when *Pr.282* ≥ *Pr.278*.	
283	Brake operation time at stop	0.3s	0 to 5s	Set the mechanical delay time until the brake is closed + 0.1s when *Pr.292* = "7 or 17". Set the mechanical delay time until the brake is closed + 0.2 to 0.3s when *Pr.292* = "8 or 18".	
284	Deceleration detection function selection	0	0	Deceleration is not detected.	
			1	If deceleration is not normal during deceleration operation, the inverter fault is provided.	
285	Overspeed detection frequency*	9999	0 to 30Hz	If (detected frequency) - (output frequency) ≥ *Pr.285* during encoder feedback control, the inverter fault (E.MB1) is provided.	
			9999	Overspeed is not detected.	
292	Automatic acceleration/ deceleration	0	0	Normal operation mode	
			3	Optimum acceleration/deceleration mode *(Refer to the Instruction Manual)*	
			5, 6	Elevator mode *(Refer to the Instruction Manual)*	
			7	Brake sequence mode 1	Disabled when the second or third function is selected
			8	Brake sequence mode 2	
			11	Shortest acceleration/deceleration mode *(Refer to the Instruction Manual)*	
			17	Brake sequence mode 1	Enabled even if the second or third function is selected
			18	Brake sequence mode 2	

* When exercising vector control with the FR-A7AP/FR-A7AL (option), this parameter changes to excessive speed deviation detection frequency. (For details, refer to the Instruction Manual.)

BCN-C22005-646

<Connection diagram>



*1 The input signal terminal used differs according to the *Pr.178 to Pr.189* settings.
*2 The output signal terminal used differs according to the *Pr.190 to Pr.196* settings.
*3 The current should be within the permissible current of transistor in the inverter. (24V 0.1ADC)

CAUTION

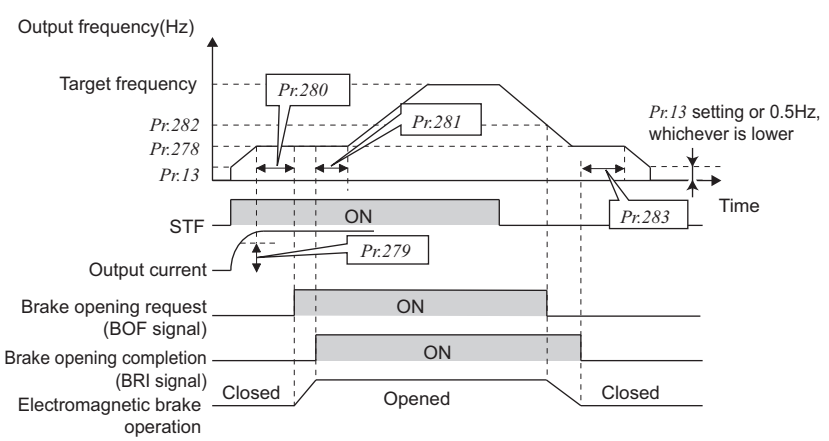
- When brake sequence mode is selected, automatic restart after instantaneous power failure is invalid.
- When using this function, set the acceleration time to 1s or longer.
- Changing the terminal function using any of *Pr.178 to Pr.189*, *Pr.190 to Pr.196* may affect the other functions. Set parameters after confirming the function of each terminal.

(1) Set the brake sequence mode

- Select either Real sensorless vector control, vector control (speed control) or Advanced magnetic flux vector control. The brake sequence function is valid only when the External operation mode, External/PU combined operation mode 1 or Network operation mode is selected.
- Set "7(17) or 8(18)" (brake sequence mode) in *Pr.292*.
  To ensure more complete sequence control, it is recommended to set "7(17)" (brake opening completion signal input) in *Pr.292*.
- Set "15" in any of *Pr.178 to Pr.189 (input terminal function selection)* and assign the brake opening completion signal (BRI) to the input terminal.
- Set "20 (positive logic)" or "120 (negative logic)" in any of *Pr.190 to Pr.196 (output terminal function selection)* and assign the brake opening request signal (BOF) to the output terminal.

(2) With brake opening completion signal input *(Pr.292* = "7 or 17")

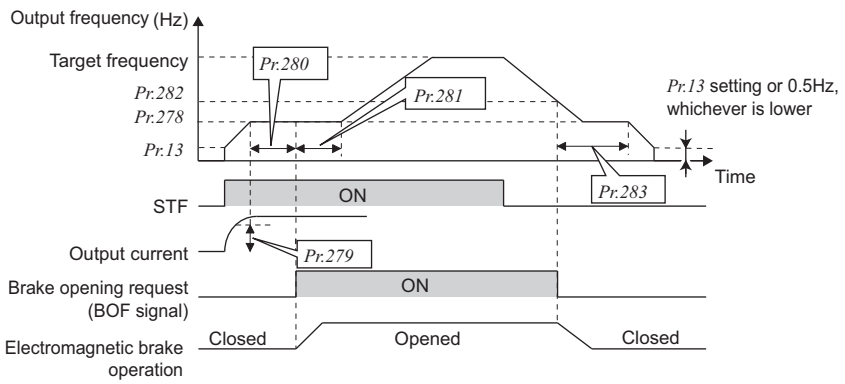
- When the start signal is input to the inverter, the inverter starts running. When the internal speed command reaches the value set in *Pr.278* and the output current is not less than the value set in *Pr.279*, the inverter outputs the brake opening request signal (BOF) after the time set in *Pr.280* has elapsed.
  When the time set in *Pr.281* elapses after the brake opening completion signal (BRI) was activated, the inverter increases the output frequency to the set speed.
- When the inverter decelerates to the frequency set in *Pr.282* during deceleration, the inverter turns OFF the BOF signal and decelerates further to the frequency set in *Pr.278*. After electromagnetic brake operation completes and inverter recognizes the turn OFF of BRI signal, the inverter holds the frequency set in *Pr.278* for the time set in *Pr.283*. And after the time set in *Pr.283* passes, the inverter decelerates again. The inverter finally stops when its frequency reaches to *Pr.13 Starting frequency* setting or 0.5Hz, whichever is lower.



(3) Without brake opening completion signal input (*Pr.292* = "8 or 18")

· When the start signal is input to the inverter, the inverter starts running. When the internal speed command reaches the value set in *Pr.278* and the output current is not less than the value set in *Pr.279*, the inverter outputs the brake opening request signal (BOF) after the time set in *Pr.280* has elapsed.
When the time set in *Pr.281* elapses after the BOF signal is output, the inverter increases the output frequency to the set speed.

· When the inverter decelerates to the frequency set in *Pr.282* during deceleration, the inverter turns OFF the BOF signal and decelerates further to the frequency set in *Pr.278*. After the turn OFF of BOF signal, the inverter holds the frequency set in *Pr.278* for the time set in *Pr.283*. And after the time set in *Pr.283* passes, the inverter decelerates again. The inverter finally stops when its frequency reaches to *Pr.13 Starting frequency* setting or 0.5Hz, whichever is lower.



(4) Relation between *Pr.292 Automatic acceleration/deceleration* and the RT, X9, or JOG signal

· The table below shows when the function of each input signal becomes available depending on the *Pr.292* setting.

Pr.292 setting	RT signal / X9 signal	JOG signal
0	Depending on the *Pr.155* setting	Always available
3, 5 to 8, 11	Only during an inverter stop	Only during an inverter stop
17, 18	Depending on the *Pr.155* setting	Only during an inverter stop

· The table below shows the relation between each input signal and the operating status depending on the *Pr.292* setting.

Pr.292 setting	Input signal status		Operating status (Automatic acceleration/deceleration / Normal operation)	
			During an inverter stop	During inverter operation
0	—		Normal operation	Normal operation
3, 5 to 8, 11	JOG signal	OFF	Automatic acceleration/deceleration (JOG invalid)	Maintains the operating status before switching of the signal
		ON	Normal operation (JOG valid)	
	RT/X9 signal	OFF	Automatic acceleration/deceleration (RT/X9 invalid)	Maintains the operating status before switching of the signal
		ON	Normal operation (RT/X9 valid)	
17, 18	JOG signal	OFF	Automatic acceleration/deceleration (JOG invalid)	Maintains the operating status before switching of the signal
		ON	Normal operation (JOG valid)	
	RT/X9 signal	OFF	Automatic acceleration/deceleration (RT/X9 invalid)	Automatic acceleration/deceleration (RT/X9 invalid)
		ON	Automatic acceleration/deceleration (RT/X9 valid)	Automatic acceleration/deceleration (RT/X9 valid)

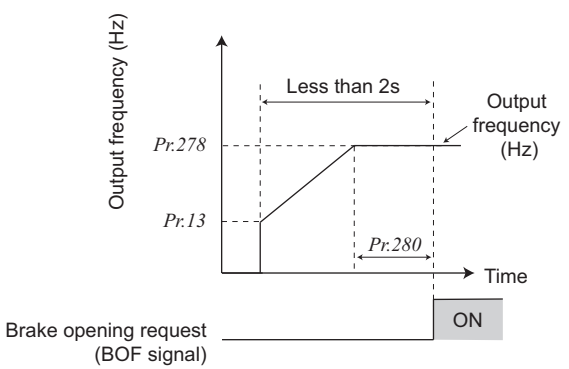
(5) Protective functions

If any of the following errors occurs in the brake sequence mode, the inverter results in a fault, trips, and turns off the brake opening request signal (BOF).

Fault Display	Description
E.MB1	(Detection frequency) - (output frequency) > *Pr.285* during encoder feedback control When *Pr.285 Overspeed detection frequency* = 9999, overspeed is not detected.
E.MB2	Deceleration is not normal during deceleration operation from the set frequency to the frequency set in *Pr.282*. (when *Pr.284* =1) (except stall prevention operation)
E.MB3	Brake opening request signal (BOF) turned on though the motor is at a stop. (gravity drop prevention function)
E.MB4	Although more than 2s have elapsed after the start command (forward or reverse rotation) is input, the brake opening request signal (BOF) does not turn on.
E.MB5	Although more than 2s have elapsed after the brake opening request signal (BOF) turned on, the brake opening completion signal (BRI) does not turn on.
E.MB6	Though the inverter had turned on the brake opening request signal (BOF), the brake opening completion signal (BRI) turned off midway.
E.MB7	Although more than 2s have elapsed after the brake opening request signal (BOF) turned off at a stop, the brake opening completion signal (BRI) does not turn off.

CAUTION

- During deceleration, inverter output is shut OFF when the frequency reaches *Pr.13 Starting frequency* or 0.5Hz, whichever is lower. For *Pr.278 Brake opening frequency*, set a frequency equal to or higher than the *Pr.13* setting or 0.5Hz.
- Overspeed detection *(Pr.285)* is valid under encoder feedback control (used with the FR-A7AP/FR-A7AL (option)) even if a value other than "7, 8, 17 or 18" is set in *Pr. 292*.
- Setting *Pr.278 Brake opening frequency* too high activates stall prevention operation and may cause E.MB4.
- If the sum of the time between *Pr.13 Starting frequency* and *Pr.278 Brake opening frequency* + *Pr.280 Brake opening current detection time* is more than 2s, E.MB4 occurs.



● Additional notes for Instructions for UL and cUL

Motor overload protection

When using the electronic thermal relay function as motor overload protection, set the rated motor current in *Pr.9 Electronic thermal O/L relay*.

CAUTION

- Motor over temperature sensing is not provided by the drive.

General precaution

CAUTION - Risk of Electric Shock -
The bus capacitor discharge time is 10 minutes. Before starting wiring or inspection, switch power off, wait for more than 10 minutes.
ATTENTION - Risque de choc électrique -
La durée de décharge du condensateur de bus est de 10 minutes. Avant de commencer le câblage ou l'inspection, mettez l'appareil hors tension et attendez plus de 10 minutes.

● SERIAL number check

Check the SERIAL number indicated on the inverter rating plate or package.
Refer to the inverter manual for the location of the rating plate.

Rating plate example

□	3	9	○○○○○○
Symbol	Year	Month	Control number

SERIAL (Serial No.)

The SERIAL consists of one symbol, two characters indicating production year and month, and six characters indicating control number.
The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December.)

BCN-C22005-646

FR-A701 Series
Instruction Manual Supplement

For the FR-A701 series manufactured in January 2015 or later, the following specifications are added. Check the year and month of manufacture by the SERIAL number printed on the rating plate of the inverter.

● SERIAL number check

Refer to the inverter manual for the location of the rating plate.

Rating plate example

□	5	1	○○○○○○
Symbol	Year	Month	Control number
SERIAL			

The SERIAL consists of one symbol, two characters indicating production year and month, and six characters indicating control number.
The last digit of the production year is indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

In the following sections, PM indicates the functions that are driven by PM sensorless vector control.

1 PM sensorless vector control PM

Purpose	Parameters to be Set		Refer to Page
To perform IPM parameter initialization	IPM parameter initialization	Pr. 998	*4*
To select the torque characteristic in a low-speed range	Low-speed range torque characteristics	Pr. 788	*14*
To adjust the gain for PM sensorless vector control	Adjusting the speed control gain	Pr. 820, Pr. 821	*Chapter 4 of the Instruction Manual (Applied)*

Highly efficient motor control and highly accurate motor speed control can be performed by using the inverter with an IPM (internal permanent magnet) motor, which is more efficient than an induction motor.

The motor speed is calculated based on the output voltage and current from the inverter. It does not require a speed detector such as an encoder. The inverter drives the IPM motor with the least required current when a load is applied in order to achieve the highest motor efficiency.

POINT

The following conditions must be met to perform PM sensorless vector control.
- For the motor model, IPM motor must be used.
- The motor capacity must be equal to or one rank lower than the inverter capacity.
- Single-motor operation (one motor run by one inverter) must be performed.
- The overall wiring length with the motor must be 100m or less. (When the wiring length exceeds 30m, offline auto tuning must be performed.)

CAUTION

- The speed setting range for an MM-CF IPM motor is between 0 and 200Hz.
- The carrier frequency is limited during PM sensorless vector control. (Refer to *page 17*)
- Constant-speed operation cannot be performed in the low-speed range of 200r/min or less under current synchronization operation. (Refer to *page 14*)
- During PM sensorless vector control, the RUN signal is output about 100ms after turning ON the start command (STF, STR). The delay is due to the magnetic pole detection.
- During PM sensorless vector control, the automatic restart after instantaneous power failure function operates only when an MM-CF IPM motor is connected. However, the frequency search may not be available at 2200 r/min or above. The restart operation cannot be performed until the motor speed drops to a frequency where the frequency search is available.

BCN-C22005-675

1.1 Setting procedure of PM sensorless vector control

· This inverter is set for a general-purpose motor in the initial setting. Follow the following procedure to change the setting for the PM sensorless vector control.

Driving an MM-CF IPM motor

Perform IPM parameter initialization by selecting IPM in the parameter setting mode on the operation panel.* (Refer to *page 3*)

Set "3003" (MM-CF IPM motor parameter setting (rotations per minute)) in "IPM" (IPM parameter initialization) to select the PM sensorless vector control.
P.RUN on the operation panel (FR-DU07) is lit when PM sensorless vector control is set.

Driving an IPM motor other than MM-CF

Set the motor. *(Pr.9, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84)* (Refer to *page 7*)

Set "8093 (IPM motor other than MM-CF)" in *Pr.71 Applied motor*. Set *Pr.9 Electronic thermal O/L relay*, *Pr.80 Motor capacity*, *Pr.81 Number of motor poles*, *Pr.83 Rated motor voltage*, and *Pr.84 Rated motor frequency* according to the motor specifications.
(Setting "9999 (initial value)" in *Pr. 80* or *Pr. 81* selects V/F control.)

Perform offline auto tuning for an IPM motor. *(Pr.96)* (Refer to *page 7*)

To perform tuning, set "1" (offline auto tuning without rotating motor (for other than MM-CF)) in *Pr. 96*.

Use *Pr.998* to perform IPM parameter initialization. (Refer to *page 4*)

Setting "8009" or "8109" in *Pr. 998 IPM parameter initialization* selects the IPM motor parameter settings.
"8009": Parameter (rotations per minute) settings for an IPM motor other than MM-CF
"8109": Parameter (frequency) settings for an IPM motor other than MM-CF

Set parameters such as the acceleration/deceleration time and multi-speed setting.

Set parameters such as the acceleration/deceleration time and multi-speed setting as required.

Set the operation command. (Refer to *the Instruction Manual.*)

Select the start command and speed command.

Test run

As required for MM-CF.

· Perform offline auto tuning for an IPM motor. (Refer to *page 7*)

* Two IPM parameter initialization methods are available for MM-CF IPM motors; setting *Pr.998 IPM parameter initialization*, and selecting "IPM" (IPM parameter initialization) mode on the operation panel. One of the two methods can be selected.
To change to the PM sensorless vector control, perform IPM parameter initialization at first. If parameter initialization is performed after setting other parameters, some of those parameters will be initialized too. (Refer to *page 6* for the parameters that are initialized.)

REMARKS

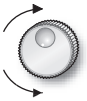
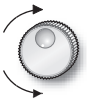
· To use a motor capacity that is one rank lower than the inverter capacity, set *Pr. 80 Motor capacity* before performing IPM parameter initialization.

(1) PM sensorless vector control setting by selecting IPM in the parameter setting mode on the operation panel (1 PN)

POINT

· The parameters required to drive an MM-CF IPM motor are automatically changed as a batch. (Refer to *page 6*)

Operation example | Initialize the parameter setting for an MM-CF IPM motor by selecting IPM in the parameter setting mode on the operation panel.

Operation	Display
1. Screen at power-ON The monitor display appears.	
2. Parameter setting mode Press (MODE) to choose the parameter setting mode.	(MODE) ⇨  The parameter number read previously appears.
3. Selecting the parameter Turn dial until 1 PN (IPM parameter initialization) appears.	 ⇨ 
4. Displaying the setting Press (SET) to read the currently set value. "0" (initial value) appears.	(SET) ⇨ 
5. Selecting the setting Turn dial to change it to the set value "3003".	 ⇨ 
6. Parameter setting Press (SET) to set.	(SET) ⇨  Flicker ... Parameter setting complete!! P.RUN indicator is lit. 

· Turn dial to read another parameter.

· Press (SET) to show the setting again.

· Press (SET) twice to show the automatic parameter setting (AUTO).

Setting	Description
0	Parameter settings for a general-purpose motor
3003	Parameter settings for an IPM motor MM-CF (rotations per minute)

REMARKS

· Performing IPM parameter initialization by selecting IPM in the parameter setting mode on the operation panel automatically changes the *Pr. 998 IPM parameter initialization* setting.

· In the initial parameter setting, the capacity same as the inverter capacity is set in *Pr. 80 Motor capacity*. (Refer to *page 18*.) To use a motor capacity that is one rank lower than the inverter capacity, set *Pr. 80 Motor capacity* before performing IPM parameter initialization by selecting the mode on the operation panel.

· To set a speed or to display monitored items in frequency, set *Pr. 998*. (Refer to *page 4*.)

(2) PM sensorless vector control display and PM sensorless vector control signal

P.RUN on the operation panel (FR-DU07) is lit and the PM sensorless vector control signal (IPM) is output during PM sensorless vector control.
For the terminal to output the PM sensorless vector control signal, assign the function by setting "57 (positive logic)" or "157 (negative logic)" in any of *Pr.190 to Pr.196 (Output terminal function selection)*.

(3) Loss of synchronism detection

Operation Panel Indication	E.SOT PM	E.SOT	FR-PU04	Fault 14
			FR-PU07	Motor step out
Name	Loss of synchronism detection			
Description	Stops the output when the operation is not synchronized. (This function is only available under PM sensorless vector control.)			
Description	· Check that the IPM motor is not driven overloaded. · Check if a start command is given to the inverter while the IPM motor is coasting. · Check if a motor other than the IPM motor (MM-CF series) is driven.			
Corrective action	· Set the acceleration time longer. · Reduce the load. · If the inverter restarts during coasting, set *Pr.57 Restart coasting time* ≠ "9999," and select the automatic restart after instantaneous power failure. · Drive an IPM motor (MM-CF series).			

1.2 Initializing the parameters required for the PM sensorless vector control (Pr.998) PM

- By performing IPM parameter initialization, PM sensorless vector control is selected and the parameters, which are required to drive an IPM motor, are selected. Initial settings and setting ranges of the parameters are adjusted automatically to drive an IPM motor.
- Two IPM parameter initialization methods are available; setting *Pr.998 IPM parameter initialization*, and selecting I PN (IPM parameter initialization) mode on the operation panel. One of the two methods can be selected.

Parameter number	Name	Initial value	Setting range	Description	
998 *1	IPM parameter initialization	0	0	Parameter settings for a general-purpose motor (frequency)	Initial parameter settings required to drive a general-purpose motor are set.
			3003	Parameter settings for an MM-CF IPM motor (rotations per minute)	Initial parameter settings required to drive an IPM motor are set.
			3103	Parameter settings for an MM-CF IPM motor (frequency)	
			8009	Parameter (rotations per minute) settings for an IPM motor other than MM-CF (after tuning) *2	
			8109	Parameter (frequency) settings for an IPM motor other than MM-CF (after tuning) *2	

*1 This parameter allows its setting to be changed in any operation mode even if "0 (initial value)" is set in *Pr. 77 Parameter write selection*.

*2 To use an IPM motor other than MM-CF, offline auto tuning must be performed for the IPM motor.

(1) *IPM parameter initialization (Pr.998)*

- To use a motor capacity that is one rank lower than the inverter capacity, set *Pr.80 Motor capacity* before performing IPM parameter initialization. By performing IPM parameter initialization, initial settings required to drive an IPM motor are set in parameters.
- When *Pr. 998* = "3003," the monitor is displayed and the frequency is set using the motor rotations per minute. To use frequency to display or set, set *Pr. 998* = "3103."
- Set *Pr. 998* = "0" to change the PM sensorless vector control parameter settings to the parameter settings required to drive a general-purpose motor.
- When using an IPM motor other than MM-CF, set *Pr. 998* = "8009 or 8109" to select the parameter settings required to perform PM sensorless vector control. The setting can be made after performing offline auto tuning for an IPM motor.

***Pr.998* Setting**	**Description**	**Operation IPM in the parameter setting mode**
0 (initial value)	Parameter settings for a general-purpose motor (frequency)	IPM (IPM)⇒ Write "0"
3003	Parameter settings for an IPM motor MM-CF (rotations per minute)	IPM (IPM)⇒ Write "3003"
3103	Parameter settings for an IPM motor MM-CF (frequency)	—
8009	Parameter (rotations per minute) settings for an IPM motor other than MM-CF (after tuning)	—
8109	Parameter (frequency) settings for an IPM motor other than MM-CF (after tuning)	—

REMARKS

- Make sure to set *Pr. 998* before setting other parameters. If the *Pr. 998* setting is changed after setting other parameters, some of those parameters will be initialized too. (Refer to "(2) " for the parameters that are initialized.)
- To change back to the parameter settings required to drive a general-purpose motor, perform parameter clear or all parameter clear.
- If the setting of *Pr. 998 IPM parameter initialization* is changed from "3003, 8009 (rotations per minute)" to "3103, 8109 (frequency)," or from "3103, 8109" to "3003, 8009," all the target parameters are initialized.

  The purpose of *Pr. 998* is not to change the display units. Use *Pr. 144 Speed setting switchover* to change the display units between rotations per minute and frequency. *Pr. 144* enables switching of display units between rotations per minute and frequency without initializing the parameter settings.

  Example) Changing the *Pr. 144* setting between "6" and "106" switches the display units between frequency and rotations per minute.

(2) IPM parameter initialization list

The parameter settings in the following table are changed to the settings required to perform PM sensorless vector control by selecting PM sensorless vector control with the IPM parameter initialization mode on the operation panel or with *Pr. 998 IPM parameter initialization* setting. The changed settings differ according to the IPM motor specification (capacity).

Performing parameter clear or all parameter clear sets back the parameter settings to the settings required to drive a general-purpose motor.

Parameter	Name	Setting					Setting increments	
		General-purpose motor	IPM motor (rotations per minute)		IPM motor (frequency)			
	Pr.998	0 (Initial setting)	3003 (MM-CF)	8009 (other than MM-CF)	3103 (MM-CF)	8109 (other than MM-CF)	3003, 8009	0, 3103, 8109
1	Maximum frequency	120Hz	3000r/min	—	200Hz	—	1r/min	0.01Hz
4	Multi-speed setting (high speed)	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
9	Electronic thermal O/L relay	Rated inverter current	Rated motor current (Refer to *page 18*)	—	Rated motor current (Refer to *page 18*)	—	0.01A	
13	Starting frequency	0.5Hz	8r/min *4	*Pr. 84* × 10%	0.5Hz *5	*Pr. 84* × 10%	1r/min	0.01Hz
15	Jog frequency	5Hz	200r/min	*Pr. 84* × 10%	13.33Hz	*Pr. 84* × 10%	1r/min	0.01Hz
18	High speed maximum frequency	120Hz	3000r/min	—	200Hz	—	1r/min	0.01Hz
20	Acceleration/deceleration reference frequency	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
22	Stall prevention operation level	150%	150%				0.1%	
37	Speed display	0	0				1	
55	Frequency monitoring reference	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
56	Current monitoring reference	Rated inverter current	Rated motor current (Refer to *page 18*)	*Pr. 859*	Rated motor current (Refer to *page 18*)	*Pr. 859*	0.01A	
71	Applied motor	0	330 *1	—	330 *1	—	1	
80	Motor capacity	9999	Motor capacity (MM-CF) *2	—	Motor capacity (MM-CF) *2	—	0.01kW	
81	Number of motor poles	9999	8	—	8	—	1	
84	Rated motor frequency	60Hz	2000r/min	—	133.33Hz	—	1r/min	0.01Hz
125 (903)	Terminal 2 frequency setting gain frequency	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
126 (905)	Terminal 4 frequency setting gain frequency	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
144	Speed setting switchover	4	108	*Pr. 81* +100	8	*Pr. 81*	1	
240	Soft-PWM operation selection	1	0				1	
263	Subtraction starting frequency	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
266	Power failure deceleration time switchover frequency	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
374	Overspeed detection level	140Hz	3150r/min	*Pr. 1 (Pr. 18)* × 105%	210Hz	*Pr. 1 (Pr. 18)* × 105%	1r/min	0.01Hz
386	Frequency for maximum input pulse	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz
390 *3	% setting reference frequency	60Hz	133.33Hz	*Pr. 84*	133.33Hz	*Pr. 84*	0.01Hz	
505	Speed setting reference	60Hz	133.33Hz	*Pr. 84*	133.33Hz	*Pr. 84*	0.01Hz	
557	Current average value monitor signal output reference current	Rated inverter current	Rated motor current (Refer to *page 18*)	*Pr. 859*	Rated motor current (Refer to *page 18*)	*Pr. 859*	0.01A	
820	Speed control P gain 1	60%	30%				1%	
821	Speed control integral time 1	0.333s	0.333s				0.001s	
824	Torque control P gain 1	100%	100%				1%	
825	Torque control integral time 1	5ms	20ms				0.1ms	
870	Speed detection hysteresis	0Hz	8r/min		0.5Hz		1r/min	0.01Hz
885	Regeneration avoidance compensation frequency limit value	6Hz	200r/min	*Pr. 84* × 10%	13.33Hz	*Pr. 84* × 10%	1r/min	0.01Hz
893	Energy saving monitor reference (motor capacity)	Rated inverter capacity	Motor capacity *(Pr. 80)*				0.01kW	
C14 (918)	Terminal 1 gain frequency (speed)	60Hz	2000r/min	*Pr. 84*	133.33Hz	*Pr. 84*	1r/min	0.01Hz

—: The setting does not change.

*1 Setting *Pr. 71 Applied motor* = one of "333, 334, 8093, 8094" does not change the *Pr. 71 Applied motor* setting.
*2 Setting *Pr. 80 Motor capacity* ≠ "9999" does not change the *Pr. 80 Motor capacity* setting.
*3 This parameter can be set when FR-A7NL is mounted.
*4 200r/min when *Pr. 788 Low-speed range torque characteristics* = "0".
*5 13.33Hz when *Pr. 788 Low-speed range torque characteristics* = "0".

REMARKS

If IPM parameter initialization is performed in rotations per minute (*Pr. 998* = "3003" or "8009"), the parameters not listed in the table above are also set and displayed in rotations per minute.

1.3 Offline auto tuning for an IPM motor (motor constant tuning) (Pr.1, Pr.9, Pr.18, Pr.71, Pr.80, Pr.81, Pr.83, Pr.84, Pr.90, Pr.92, Pr.93, Pr.96, Pr.684, Pr.706, Pr.707, Pr.711, Pr.712, Pr.721, Pr.724, Pr.725, Pr.859) PM

The offline auto tuning for an IPM motor enables the optimal operation of an IPM motor.

- What is offline auto tuning?
  Under PM sensorless vector control, setting motor constants automatically (offline auto tuning) enables optimal operation of motors even when motor constants vary or when the wiring distance is long. The offline auto tuning also enables the operation with an IPM motor other than MM-CF.

Parameter Number	Name	Initial Value	Setting Range	Description
1	Maximum frequency	120Hz	0 to 120Hz	Set the upper limit of the output frequency.
9	Electronic thermal O/L relay	Rated inverter current	0 to 500A	Set the rated motor current.
18	High speed maximum frequency	120Hz	120 to 400Hz	Set when performing the operation at 120Hz or more. (Limited at 300Hz under PM sensorless vector control)
71	Applied motor	0	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54, 330, 333, 334, 8093, 8094	Setting a motor type selects its thermal characteristic and the motor constant.
80	Motor capacity	9999	0.4 to 55kW	Set the applied motor capacity.
			9999	V/F control
81	Number of motor poles	9999	2, 4, 6, 8, 10	Set the number of motor poles.
			12, 14, 16, 18, 20	X18 signal-ON:V/F control / Set 10 + number of motor poles.
			9999	V/F control
83	Rated motor voltage	200/400V *	0 to 1000V	Set the rated motor voltage (V).
84	Rated motor frequency	60Hz	10 to 300Hz	Set the rated motor frequency (Hz). (Limited at 120Hz when *Pr. 71* is set to a motor other than IPM)
90	Motor constant (R1)	9999	0 to 50Ω, 9999	Tuning data (The value measured by offline auto tuning is automatically set.) 9999: Motor constant of the MM-CF IPM motor. (Except 9999, the set value is the motor constant.)
92	Motor constant (L1)/d-axis inductance	9999	0 to 50Ω, (0 to 1000mH), 9999	
93	Motor constant (L2)/q-axis inductance	9999	0 to 50Ω, (0 to 1000mH), 9999	
96	Auto tuning setting/status	0	0	Offline auto tuning is not performed
			1	Offline auto tuning is performed without motor running (other than MM-CF)
			11	Offline auto tuning is performed without motor running (MM-CF)
			101	Offline auto tuning by rotating a general-purpose motor (no tuning during PM sensorless vector control)
684	Tuning data unit switchover	0	0	Internal data converted value
			1	Displayed in "A, Ω, mH, %"
706	Induced voltage constant	9999	0 to 5000mV • s/rad	Adjust the constant if the current fluctuates during operation after tuning.
			9999	Constant value calculated based on the tuning data
707	Motor inertia (integer)	9999	10 to 999	Set the motor inertia.
			9999	Uses the inertia of the MM-CF IPM motor

Parameter Number	Name	Initial Value	Setting Range	Description
711	Motor d-axis inductance Ld decay ratio	9999	0 to 100%, 9999	Tuning data (The value measured by offline auto tuning is automatically set.) 9999: Motor constant of the MM-CF IPM motor. (Except 9999, the set value is the motor constant.)
712	Motor q-axis inductance Lq decay ratio	9999	0 to 100%, 9999	
721	Starting magnetic pole position detection pulse width	9999	0 to 6000μs, 9999	
724	Motor inertia (exponent)	9999	1 to 7	Set the motor inertia.
			9999	Uses the inertia of the MM-CF IPM motor
725	Motor protection current level	9999	0 to 500%	Set the maximum current (OCT) level of the motor (%).
			9999	Uses the maximum current of MM-CF
859	Torque current	9999	0 to 500A	Tuning data (The value measured by offline auto tuning is automatically set.)
			9999	Uses the constant of the MM-CF IPM motor

* The initial value differs according to the voltage level. (200V/400V)

POINT

- The settings are valid only under the PM sensorless vector control.
- When the wiring length between the inverter and the motor is long (30m or longer as a reference), use the offline auto tuning function to drive the motor in the optimum operation characteristic.
- The offline auto tuning enables the operation with an IPM motor other than MM-CF.
- Tuning is enabled even when a load is connected to the motor. (As the load is lighter, tuning accuracy is higher. Tuning accuracy does not change even if the inertia is large.)
- Reading/writing of motor constants tuned by offline auto tuning are enabled. You can copy the offline auto tuning data (motor constants) to another inverter with the PU (FR-DU07/FR-PU07).
- The offline auto tuning status can be monitored with the PU (FR-DU07/FR-PU07/FR-PU04).
- Do not use an inverter with a surge voltage suppression filter (FR-ASF-H/FR-BMF-H) connected between the inverter and the motor.

(1) Before performing offline auto tuning

Check the following before performing offline auto tuning.

- The PM sensorless vector control should be selected.
- A motor should be connected. Note that the motor should be at a stop at a tuning start.
- The motor capacity should be equal to or one rank lower than the inverter capacity.
- The maximum frequency under PM sensorless vector control should be 300Hz.
- Even if tuning is performed without motor running (*Pr. 96 Auto tuning setting/status* = "11"), the motor may run slightly. Therefore, fix the motor securely with a mechanical brake, or before tuning, make sure that there will be no problem in safety if the motor runs. (Caution is required especially in vertical lift applications). Note that if the motor runs slightly, tuning performance is unaffected.
- Tuning is not available during position control under PM sensorless vector control.

(2) Setting

To perform tuning, set the following parameters about the motor.

Parameter Number	Name	Setting for an IPM motor other than MM-CF	Setting for MM-CF
80	Motor capacity	Motor capacity (kW)	Set by the IPM parameter initialization (Refer to *page 4.*)
81	Number of motor poles	Number of motor poles	
1(18)	Maximum frequency (High speed maximum frequency)	The maximum motor frequency (Hz)	
9	Electronic thermal O/L relay	Rated motor current (A)	
84	Rated motor frequency	Rated motor frequency (Hz)	
83	Rated motor voltage	Rated motor voltage (V)	Rated motor voltage (V) printed on the motor's rating plate.
707	Motor inertia (integer)	Motor inertia Jm = $Pr.707 \times 10^{(-Pr.724)}$ (kg•m^2)	9999 (Initial value)
724	Motor inertia (exponent)		
725	Motor protection current level	Maximum current (OCT) level of the motor (%)	9999 (Initial value)
71	Applied motor	8093	333
96	Auto tuning setting/status	1	11

(3) Execution of tuning

CAUTION

· Before performing tuning, check the monitor display of the operation panel (FR-DU07) or parameter unit (FR-PU04/ FR-PU07) if the inverter is in the state ready for tuning. (Refer to 2) below) Turning ON the start command while tuning is unavailable starts the motor.

1)When performing PU operation, press FWD / REV on the operation panel.

For External operation, turn ON the start command (STF signal or STR signal). Tuning starts.

REMARKS

· Satisfy the required inverter start conditions to start offline auto tuning. For example, stop the input of MRS signal.

· To force tuning to end, use the MRS or RES signal or press STOP RESET on the operation panel.
(Turning the start signal (STF signal or STR signal) OFF also ends tuning.)

· During offline auto tuning, only the following I/O signals are valid (initial value):
· Input signals <valid signal> STOP, OH, MRS, RT, RES, STF, STR
· Output terminal RUN, OL, IPF, FM, AM, A1B1C1
Note that the progress status of offline auto tuning is output in fifteen steps from AM and FM when speed and output frequency are selected.

· Do not perform ON/OFF switching of the second function selection signal (RT) during execution of offline auto tuning. Auto tuning is not executed properly.

· Setting offline auto tuning (*Pr. 96 Auto tuning setting/status* = "1 or 11") will make pre-excitation invalid.

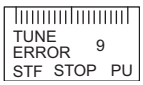
CAUTION

· Since the RUN signal turns ON when tuning is started, caution is required especially when a sequence which releases a mechanical brake by the RUN signal has been designed.

· When executing offline auto tuning, input the run command after switching ON the main circuit power (R/L1, S/L2, T/L3) of the inverter.

· While *Pr. 79* = "7," turn the X12 signal ON to tune in the PU operation mode.

2)Monitor is displayed on the operation panel (FR-DU07) and parameter unit (FR-PU07/FR-PU04) during tuning as below.

	Parameter Unit (FR-PU07/FR-PU04) Display		Operation Panel (FR-DU07) Display	
Pr. 96 setting	1	11	1	11
(1) Setting	READ:List 1 --- STOP PU	READ:List 11 --- STOP PU		
(2) Tuning in progress	TUNE 2 STF FWD PU	TUNE 12 STF FWD PU		
(3) Normal end	TUNE 3 COMPLETION STF STOP PU	TUNE 13 COMPETION STF STOP PU	 Flickering	 Flickering
(4) Error end (when the inverter protective function is activated)				

3)When offline auto tuning ends, press STOP RESET of the operation panel during PU operation. For External operation, turn OFF the start signal (STF signal or STR signal).
This operation resets the offline auto tuning and the PU's monitor display returns to the normal indication. (Without this operation, next operation cannot be started.)

REMARKS

- The motor constants measured once in the offline auto tuning are stored as parameters and their data are held until the offline auto tuning is performed again.
- Changing *Pr. 96* setting from "3 or 13" after tuning completion will invalidate the tuning data. In this case, tune again.

4)If offline auto tuning ended in error (see the table below), motor constants are not set.
Perform an inverter reset and restart tuning.

Error Display	Error Cause	Remedy
8	Forced end	Set "1" or "11" in *Pr. 96* and perform tuning again.
9	Inverter protective function operation	Make setting again.
92	Converter output voltage has reached 75% of rated value.	Check for fluctuation of power supply voltage.
93	Calculation error A motor is not connected.	Check the motor wiring and make setting again.

5)When tuning is ended forcibly by pressing STOP RESET or turning OFF the start signal (STF or STR) during tuning, offline auto tuning does not end properly. (The motor constants have not been set.)
Perform an inverter reset and restart tuning.

CAUTION

- An instantaneous power failure occurring during tuning will result in a tuning error.
  After power is restored, the inverter goes into the normal operation mode. Therefore, when STF (STR) signal is ON, the motor runs in the forward (reverse) rotation.
- Any alarm occurring during tuning is handled as in the ordinary mode. Note that even if a retry operation has been set, retry is not performed.
- The set frequency monitor displayed during the offline auto tuning is 0Hz.

⚠ CAUTION

⚠ Note that the motor may start running suddenly.

(4) Utilizing or changing offline auto tuning data

The data measured in the offline auto tuning can be read and utilized or changed.
<Operating procedure>
1)Set *Pr. 71* according to the motor used.

Motor		*Pr. 71* Setting
IPM motor	MM-CF	334
	Other than MM-CF	8094

2) In the parameter setting mode, read the following parameters and set desired values.
The display units of the read motor constants can be changed with *Pr. 684 Tuning data unit switchover*.
Setting *Pr.684* = "1" does not change the parameter settings.

Parameter Number	Name	Setting Increments		Read Value		Setting Range
		Pr.684 = 0	*Pr.684* = 1	*Pr.71* = 334	*Pr.71* = 8094	
90	Motor constant (R1)	Internal data	0.001Ω	Tuned data *1	Tuned data *1	0 to ***, 9999
92	Motor constant (L1)/d-axis inductance	Internal data	0.1mH	9999 *2	Tuned data *1	0 to ***, 9999
93	Motor constant (L2)/q-axis inductance	Internal data	0.1mH	9999 *2	Tuned data *1	0 to ***, 9999
711	Motor d-axis inductance Ld decay ratio	Internal data	0.1%	9999 *2	Tuned data *1	0 to ***, 9999
712	Motor q-axis inductance Lq decay ratio	Internal data	0.1%	9999 *2	Tuned data *1	0 to ***, 9999
721	Starting magnetic pole position detection pulse width	Internal data	1(μs)	9999 *2	Tuned data *1	0 to ***, 9999
859	Torque current	Internal data	0.01A	Tuned data *1	Tuned data *1	0 to ***, 9999

*1 As the motor constants measured in the offline auto tuning have been converted into internal data (****), refer to the following setting example when making setting:
Setting example To slightly increase *Pr. 90* value (5%)
When *Pr. 90* is displayed "2516",
set 2642, i.e. 2516 × 1.05 = 2641.8, in *Pr. 90* .
(The value displayed has been converted into a value for internal use. Hence, simple addition of a given value to the displayed value has no significance.)

*2 Setting "9999" selects the IPM motor (MM-CF) constant.

If the current fluctuates after tuning, adjust the constant by referring to the induced voltage constant, which can be found in the data sheet.

Parameter Number	Name	Setting Range	Setting Increments	Initial Setting
706	Induced voltage constant	0 to 5000, 9999	0.1(mV/(rad/s))	9999 *

* Setting "9999" sets a calculated value based on tuning.

1.4 Applied motor (Pr. 71)

Setting of the used motor selects the thermal characteristic appropriate for the motor.
Setting is necessary when using a constant-torque motor. Thermal characteristic of the electronic thermal relay function suitable for the motor is set.
When PM sensorless vector control is selected, the motor constants (MM-CF etc.) necessary for control are selected as well.

Parameter Number	Name	Initial Value	Setting Range	Description
71	Applied motor	0	0 to 8, 13 to 18, 30, 33, 34, 40, 43, 44, 50, 53, 54, **330, 333, 334, 8093, 8094**	Selecting the standard motor or constant-torque motor sets the corresponding motor thermal characteristic.

(1) Set the motor to be used

Refer to the following list and set this parameter according to the motor used.

Pr. 71 Setting	Motor		Electronic thermal relay function operation characteristic	
			Constant torque	IPM
330*	IPM Motor MM-CF			○
333*	IPM Motor MM-CF	Select "offline auto tuning setting"		○
8093	IPM Motor (other than MM-CF)		○	
334*	IPM Motor MM-CF	Auto tuning data can be read, changed, and set		○
8094	IPM Motor (other than MM-CF)		○	

* The setting is available for FR-A721-11K or lower.

REMARKS

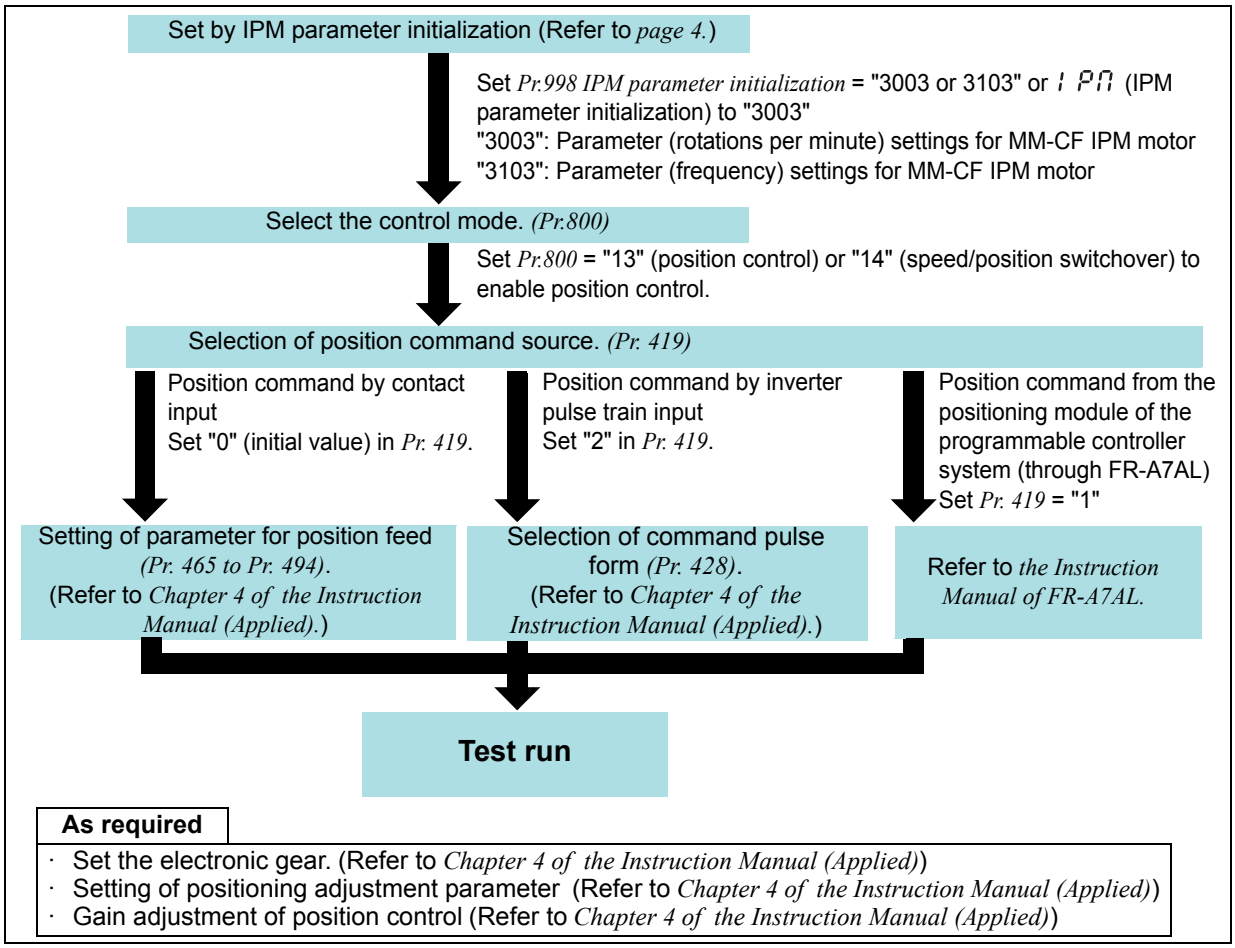
- When performing offline auto tuning, set "3, 7, 8, 13, 17, 18, 33, 43, 53, 333, 8093" in *Pr. 71*.
  (Refer to *page 7* for offline auto tuning)
- For the 5.5K and 7.5K, the *Pr. 0 Torque boost* and *Pr. 12 DC injection brake operation voltage* settings are automatically changed according to the *Pr. 71* setting as follows.

Pr.71	Standard Motor Setting 0, 2, 3 to 8, 40, 43, 44, 330, 333, 334, 8093, 8094	Constant Torque Motor Setting 1, 13 to 18, 50, 53, 54
Pr. 0	3%	2%
Pr. 12	4%	2%

1.5 Position control under PM sensorless vector control (Pr.800) PM

- In position control, speed commands, which are calculated to eliminate the difference between the command pulse (parameter setting) and the estimated feedback pulse, are output to rotate the motor.
- This inverter can perform simple position feed by contact input, position control by inverter simple pulse input, and position control by FR-A7AL pulse train input.

(1) Setting procedure



CAUTION

- The carrier frequency is limited during PM sensorless vector control. (Refer to page 17.)
- Position deviation may occur due to motor temperature changes. In such case, shut off the inverter outputs, and restart.
- The Z-phase outputs cannot be made under PM sensorless vector control. When Pr.419 = "1" is set to send positioning commands in pulses via a programmable controller positioning module and FR-A7AL, use the home position return operation that does not require Z-phase signals.

(2) Select the control method

Pr.998	Pr.998 Setting	Control Method	Control Type	Remarks
3003, 3103 (MM-CF)	20 (Initial Value)	PM sensorless vector control	Speed control	—
	9		Test operation	—
	13		Position control	—
	14		Speed control/position control switchover	MC signal ON: position control MC signal OFF: speed control

* The operation for the setting of "20" is performed when a value other than "9, 13, or 14" is set.

REMARKS

- Perform position control under PM sensorless vector control only when using an MM-CF IPM motor with the low-speed range high-torque characteristic enabled (Pr.788 = "9999 (initial value)")
- Position control is performed on the assumption of 4096 pulses/motor rotation. Positioning accuracy 100 pulses/rev (no load)

Refer to *Chapter 4 of the Instruction Manual (Applied)* for the detail of the position control.

1.6 Low-speed range torque characteristics (Pr.788) PM

Torque characteristics in a low-speed range can be changed.

Parameter Number	Name	Initial Setting	Setting Range	Operation
788 PM	Low-speed range torque characteristics	9999	0	Disables the low-speed range high-torque characteristic (current synchronization operation).
			9999*	Enables the low-speed range high-torque characteristic (high frequency superposition control)

* Current synchronization operation is always performed for IPM motors other than MM-CF, even if "9999" is set.

(1) When the low-speed range high-torque characteristic is enabled ("9999" (initial value))

- The high frequency superposition control provides enough torque in the low-speed range operation.
- Refer to *page 19* for the torque characteristics.

(2) When the low-speed range high-torque characteristic is disabled ("0")

- The current synchronization operation reduces much motor noise compared with the high frequency superposition control.
- The torque in a low-speed range is low. Use this setting for an operation with light start-up load.
- Refer to *page 19* for the torque characteristics.

REMARKS

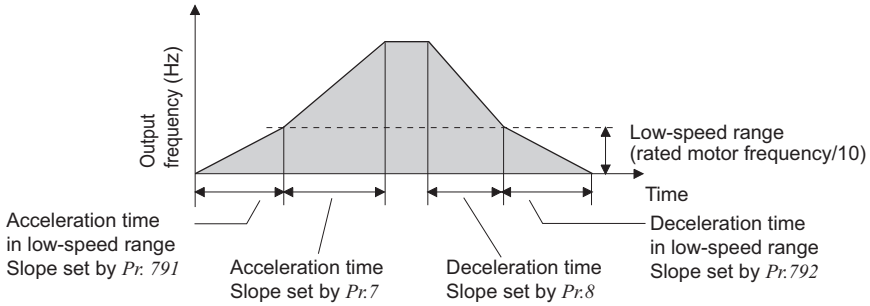
- Position control under PM sensorless vector control is not available when the current synchronization operation is selected.

1.7 Setting the acceleration/deceleration time in the low-speed range (Pr.791, Pr.792) PM

Parameter Number	Name	Initial Value	Setting Range	Description
791 PM	Acceleration time in low-speed range	9999	0 to 3600/360s*	Set the acceleration time in a low-speed range (less than 10% of the rated motor frequency).
			9999	The acceleration time set in *Pr.7* is applied. (When the second functions are enabled, the settings are applied.)
792 PM	Deceleration time in low-speed range	9999	0 to 3600/360s*	Set the deceleration time in a low-speed range (less than 10% of the rated motor frequency).
			9999	The deceleration time set in *Pr.8* is applied. (When the second functions are enabled, the settings are applied.)

* Depends on the *Pr. 21 Acceleration/deceleration time increments* setting. The initial value for the setting range is "0 to 3600s" and the setting increments is "0.1s".

If torque is required in a low-speed range (less than 10% of the rated motor frequency), set *Pr.791 Acceleration time in low-speed range* and *Pr.792 Deceleration time in low-speed range* settings higher than the *Pr.7 Acceleration time* and *Pr.8 Deceleration time* settings so that the mild acceleration/deceleration is performed in the low-speed range. Such a setting is especially effective when the low-speed range high-torque characteristic is disabled (*Pr.788* = "0"). (For an operation with second acceleration/deceleration times, set the acceleration/deceleration times longer than the second acceleration/deceleration times.)



REMARKS

- Set *Pr.791* higher than *Pr.7*, and *Pr.792* higher than *Pr.8*. If set as *Pr.791* < *Pr.7*, the operation is performed as *Pr.791* = *Pr.7*. If set as *Pr.792* < *Pr.8*, the operation is performed as *Pr.792* = *Pr.8*.
- Refer to *page 6* for the rated motor frequency of MM-CF.

1.8 Braking operation selection for vector control, PM sensorless vector control (Pr.802) Vector P M

The pre-excitation operation selection is available under PM sensorless vector control.

- Select the braking operation when the pre-excitation is performed with *Pr.802 Pre-excitation selection* from either zero speed control or servo lock.

Pr.802 setting	Pre-excitation	Description
0 (initial value)	Zero speed control	It will try to maintain 0 r/min so the motor shaft will not rotate even when a load is applied. However, it will not return to its original position when the shaft moves due to external force. It will not perform position control, but operate only with the speed control.
1	Servo lock	It will try to maintain the position of the motor shaft even if a load is applied. When the shaft moves due to external force, it will return to its original position after the external force is removed. To perform the position control, this loop gain can be adjusted with *Pr.422 Position control gain*.

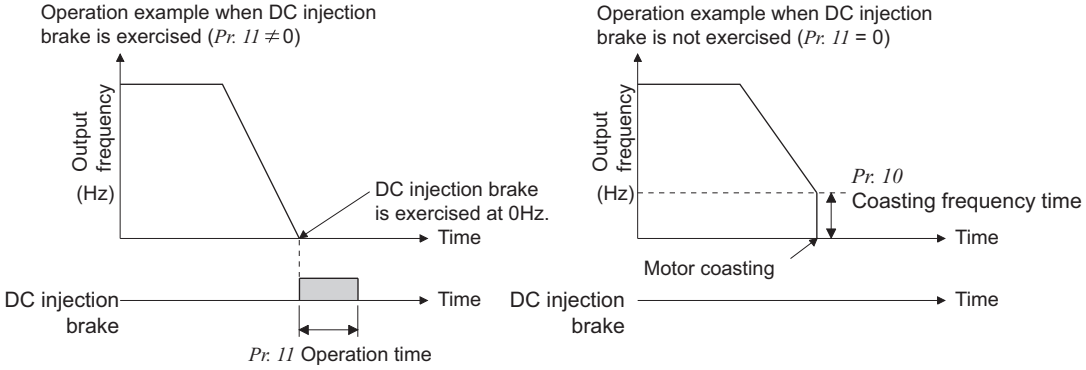
- The relation between the DC injection brake operation and pre-excitation operation is as follows.

Control method	Control mode	Pr.802	Pr.850	Deceleration stop	LX-ON	X13-ON (Pr.11 = "8888")
V/F control	—	—	—	DC injection brake	—	DC injection brake
Advanced magnetic flux vector control	—	—	—	DC injection brake	—	DC injection brake
Real sensorless vector control	Speed	—	0	DC injection brake	Zero speed	Zero speed
		—	1	Zero speed		
		—	2	Magnetic flux decay output shutoff	Zero speed	Zero speed
	Torque	—	0	DC injection brake	Zero speed	Zero speed
		—	1	Zero speed		
		—	2	Magnetic flux decay output shutoff	Zero speed	Zero speed
Vector control	Speed	0	—	Zero speed	Zero speed	Zero speed
		1	—	Servo lock	Servo lock	Servo lock
	Torque	—	—	Zero speed	Zero speed	Zero speed
	Position	—	—	—	Servo lock	—
PM sensorless vector control, low-speed range high-torque mode disabled	Speed	—	—	DC injection brake	—	—
PM sensorless vector control, low-speed range high-torque mode enabled	Speed	0	—	Zero speed	Zero speed	—
		1	—	Servo lock	Servo lock	—
	Position	—	—	—	Servo lock	—

1.9 DC injection brake of the PM sensorless vector control

DC injection brake operation frequency will be fixed to 0 Hz at the time of PM sensorless vector control (low-speed range high-torque mode disabled).

<When the low-speed range high-torque characteristic is disabled (*Pr.788* = "0")>



REMARKS

- The X13 signal is disabled during PM sensorless vector control.
- *Pr.12 DC injection brake operation voltage* is invalid during PM sensorless vector control.

1.10 PM sensorless vector control specification

Item	Specification	
Control method	Sensorless vector control Low-speed range: Control method in a low-speed range can be selected by parameter (high frequency superposition control (initial setting) / current synchronization operation)	
Starting torque	High frequency superposition control	150% (Used in combination with MM-CF)
	Current synchronization operation	50%
Speed control range	High frequency superposition control	1:1000 (Use a one rank higher inverter for the ratio of 1:1000)
	Current synchronization operation	1:10
Zero speed	High frequency superposition control	Possible (Use a one rank higher inverter for zero-speed 200%)
	Current synchronization operation	Not available
Carrier frequency	High frequency superposition control	6kHz (*Pr.72* = "0 to 9"), 10kHz (*Pr.72* = "10 to 13"), 14kHz (*Pr.72* = "14, 15") (6kHz in a low-speed range of 10kHz or higher. 2kHz is not selectable.)
	Current synchronization operation	2kHz (*Pr.72* = "0 to 5"), 6kHz (*Pr.72* = "6 to 9"), 10kHz (*Pr.72* = "10 to 13"), 14kHz (*Pr.72* = "14, 15") (6kHz in a low-speed range of 10kHz or higher.)
Position control	High frequency superposition control	Possible
	Current synchronization operation	Not available
Offline auto tuning for an IPM motor	Possible	
Applicable motor	Mitsubishi MM-CF series IPM motors (3.5 to 7.0kW) IPM motors other than MM-CF (tuning required) (no capacity limit)	

1.11 Motor specification

(1) Specifications

Item \ Motor		2000r/min Series		
		MM-CF352(C)(B)	MM-CF502(C)	MM-CF702(C)
Compatible inverter	FR-A721-☐	-	5.5K	7.5K
		5.5K *6	7.5K *6	11K *6
Continuous characteristics *1	Rated output [kW]	3.5	5.0	7.0
	Rated torque [N•m]	16.70	23.86	33.41
Rated speed *1 [r/min]		2000		
Max. speed [r/min]		3000		
Instantaneous permissible speed [r/min]		3450		
Max. torque [N•m]		33.41	47.73	66.82
Inertia moment J *5 [$\times 10^{-4}$kg•m^2]		85.6 (89.0)	120.0	160.0
Recommended ratio of load inertia moment to motor shaft inertia moment *2		50 times max.		
Rated current [A]		12.5	20.5	27.0
Insulation rank		Class F		
Structure		Totally-enclosed, self-cooling (protective system:IP44 *3, IP65 *3, *4)		
Environmental conditions	Surrounding air temperature and humidity	-10C° to +40C° (non-freezing) • 90%RH or less (non-condensing)		
	Storage temperature and humidity	-20C° to +70C° (non-freezing) • 90%RH or less (non-condensing)		
	Ambience	Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust and dirt		
	Altitude	Max. 1000m above sea level		
	Vibration	X: 9.8m/s^2, Y: 24.5m/s^2		
Mass *5 [kg]		19 (28)	27	36

*1 When the power supply voltage drops, we cannot guarantee the above output and rated speed.

*2 When the load torque is 20% of the motor rating. The permissible load inertia moment ratio is smaller when the load torque is larger. Consult us if the load inertia moment ratio exceeds the above value.

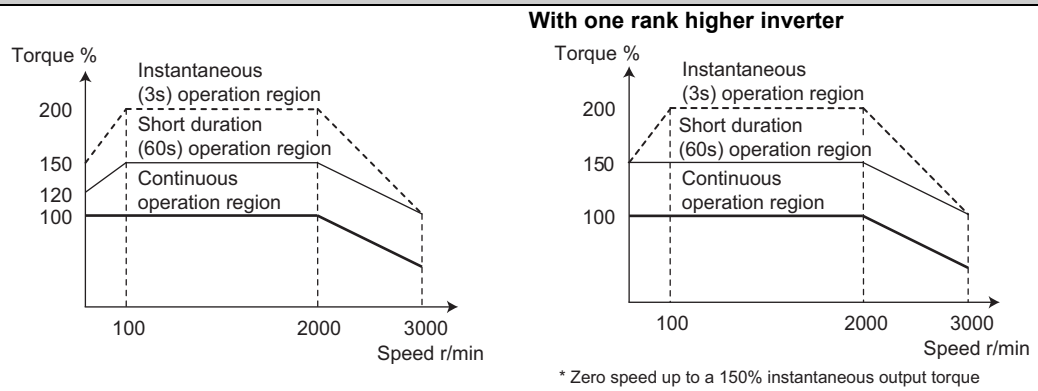
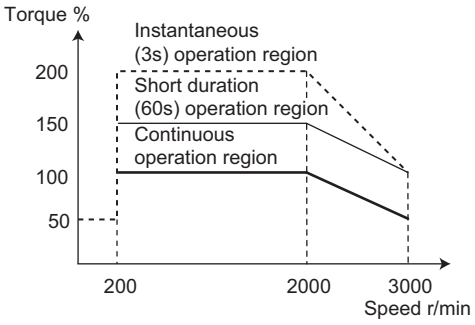
*3 This does not apply to the shaft through portion.

*4 Value for MM-CF☐2C.

*5 The value for MM-CF☐2B is indicated in parentheses.

*6 Applicable one-rank higher inverters for the lifted low-speed range torque operation.

(2) Torque characteristics

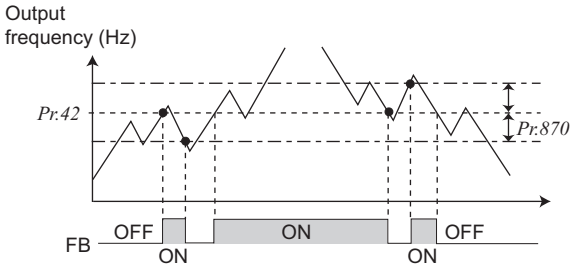
Low-speed range high-torque characteristic	Torque characteristic
Enabled (Pr.788 = "1")	
Disabled (Pr.788 = "0")	

2 Speed detection hysteresis (Pr.870)

This function prevents chattering of the speed detection signals.

Parameter Number	Name	Initial Value	Setting Range	Description
870	Speed detection hysteresis	0Hz*	0 to 5Hz	Set the hysteresis width for the detected frequency.

* Performing IPM parameter initialization changes the settings. (Refer to *page 6*)



Example of the speed detection signal (FB)

- When an output frequency fluctuates, the following signals may repeat ON/OFF (chatters).
  - Up to frequency (SU)
  - Speed detection (FB, FB2, FB3)
  - Low speed output (LS)

  Setting hysteresis to the detected frequency prevents chattering of these signals.

REMARKS

- Setting a higher value to this parameter slows the response of frequency detection signals (SU, FB, FB2, FB3, and LS).
- The ON/OFF logic for the LS signal is opposite for the FB signal.

3 Extended parameter setting ranges (Pr. 263, Pr. 505, Pr. 885)

The setting ranges of the following parameters have been extended.

(1) Power failure-time deceleration-to-stop function

Parameter Number	Name	Initial Value	Setting Range	Description
263	**Subtraction starting frequency**	60 Hz	0 to 400 Hz	When output frequency ≥ *Pr. 263* Decelerate from the speed obtained from output frequency minus *Pr. 262*. When output frequency < *Pr. 263* Decelerate from output frequency
			9999	Decelerate from the speed obtained from output frequency minus *Pr. 262*.

(2) Speed display and speed setting

Parameter Number	Name	Initial Value	Setting Range	Description
505	**Speed setting reference**	60 Hz	1 to 400 Hz	Set the reference speed for *Pr. 37*.

(3) Regeneration avoidance function

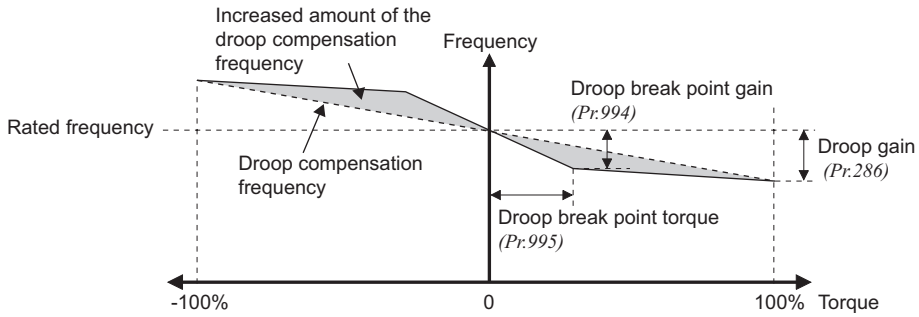
Parameter Number	Name	Initial Value	Setting Range	Description
885	**Regeneration avoidance compensation frequency limit value**	6 Hz	0 to 30 Hz	Set the limit value of frequency which rises at activation of regeneration avoidance function.
			9999	Frequency limit invalid

4 Break point setting for droop control (Pr.994, Pr.995)

Magnetic flux Sensorless Vector P M

Set *Pr.994* and *Pr.995* to have a break point on a droop compensation frequency line. Setting a break point allows the inverter to raise the droop compensation frequency for light-load (no load) operation without raising it for heavy-load operation.

Parameter Number	Name	Initial Value	Setting Range	Description
994	**Droop break point gain**	9999	0.1 to 100%	Set the changing droop amount as a percentage value of the rated motor frequency.
			9999	No function
995	**Droop break point torque**	100%	0.1 to 100%	Set the torque where the droop amount is changed.



CAUTION

The droop break point function is disabled when any of the following conditions is met. (Linear compensation by *Pr.286* is performed.)

- *Pr.995* = "100% (initial value)"
- *Pr.286* < *Pr.994*
- *Pr.994* ≤ *Pr.995* × *Pr.286* / 100%

5 Setting multiple parameters as a batch (Pr.999)

- Parameter settings are changed as a batch. Those include communication parameter settings for the Mitsubishi human machine interface (GOT) connection, rated frequency settings of 50Hz/60Hz, and acceleration/deceleration time increment settings.
- Multiple parameters are changed automatically. Users do not have to consider each parameter number. (Automatic parameter setting mode)

Parameter Number	Name	Initial Value	Setting Range	Description
999 *1	**Automatic parameter setting**	9999 *2	10	GOT initial setting (PU connector)
			11	GOT initial setting (RS-485 terminals)
			20	50Hz rated frequency
			21	60Hz rated frequency
			30	Acceleration/deceleration time (0.1s increment)
			31	Acceleration/deceleration time (0.01s increment)
			9999	No action

*1 This parameter allows its setting to be changed in any operation mode even if "0 (initial value)" is set in *Pr. 77 Parameter write selection*.
*2 The read value is always "9999."

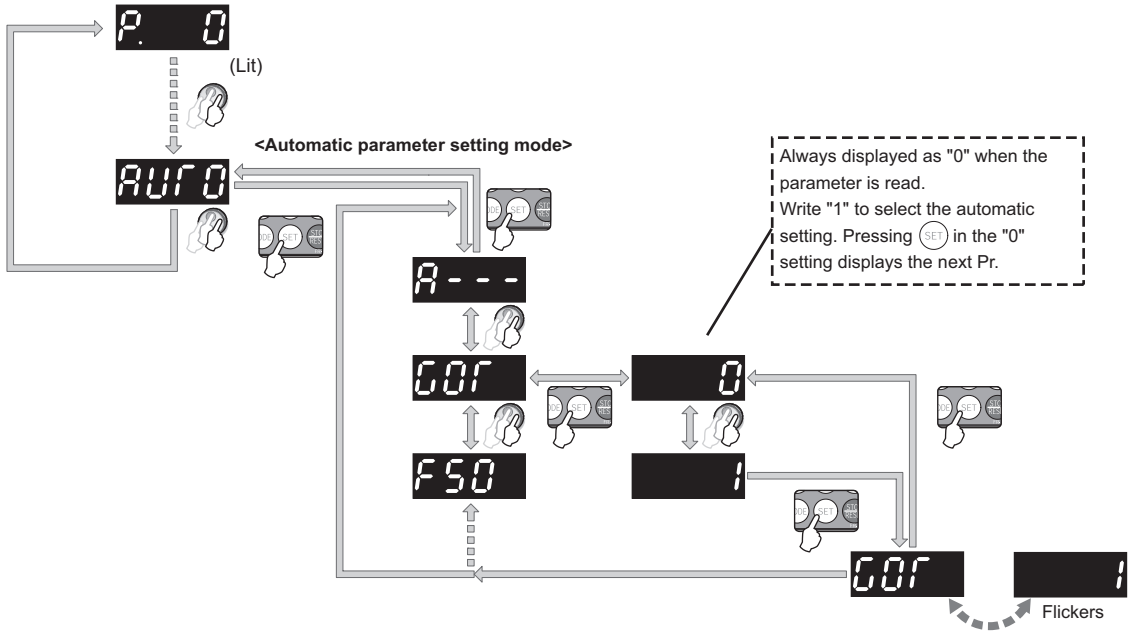
(1) Automatic parameter setting *(Pr.999)*

- Select which parameters to be automatically set, and set that to *Pr. 999*. Multiple parameter settings are changed automatically. Refer to *page 23* for the list of parameters that are changed automatically.

Pr.999 setting	Description		Operation in the automatic parameter setting mode
10	Automatically sets the communication parameters for the GOT connected with a PU connector		AUTO (AUTO) → GOT (GOT) → Write "1"
11	Automatically sets the communication parameters for the GOT connected with RS-485 terminals		—
20	50Hz rated frequency	Sets the related parameters of the rated frequency according to the power supply frequency	AUTO (AUTO) → F50 (F50) → Write "1"
21	60Hz rated frequency		—
30	0.1s increment	Changes the setting increments of acceleration/deceleration time parameters without changing acceleration/deceleration settings	—
31	0.01s increment		AUTO (AUTO) → T0.01 (T0.01) → Write "1"

REMARKS

If the automatic setting is performed, the selected settings including the changed parameter settings will be changed.



(2) List of automatically-set parameters

The following tables show which parameters are changed in each of the automatic parameter settings.

CAUTION

· If the automatic setting is performed with *Pr.999* or the automatic parameter setting mode, the listed settings including the changed parameter settings (changed from the initial setting) will be automatically changed. Before performing the automatic setting, confirm that changing the listed parameters will not cause any problem.

· GOT initial setting (PU connector) (*Pr.999* = "10")

Parameter	Name	Initial value	Automatically set to	Refer to
79	**Operation mode selection**	0	1	*Chapter 4 of the Instruction Manual (Applied)*
118	**PU communication speed**	192	192	
119	**PU communication stop bit length**	1	10	
120	**PU communication parity check**	2	1	
121	**Number of PU communication retries**	1	9999	
122	**PU communication check time interval**	9999	9999	
123	**PU communication waiting time setting**	9999	0ms	
124	**PU communication CR/LF selection**	1	1	
340	**Communication startup mode selection**	0	0	

REMARKS

Always perform an inverter reset after the initial setting.

· GOT initial setting (RS-485 terminals) (*Pr.999* = "11")

Parameter	Name	Initial value	Automatically set to	Refer to
79	**Operation mode selection**	0	0	*Chapter 4 of the Instruction Manual (Applied)*
332	**RS-485 communication speed**	96	192	
333	**RS-485 communication stop bit length**	1	10	
334	**RS-485 communication parity check selection**	2	1	
335	**RS-485 communication retry count**	1	9999	
336	**RS-485 communication check time interval**	0s	9999	
337	**RS-485 communication waiting time setting**	9999	0ms	
340	**Communication startup mode selection**	0	1	
341	**RS-485 communication CR/LF selection**	1	1	
549	**Protocol selection**	0	0	

REMARKS

Always perform an inverter reset after the initial setting.

· Rated frequency (*Pr. 999* = "20(50Hz), 21(60Hz)")

Parameter	Name	Initial value	*Pr.999* = "21"	*Pr.999* = "20" Automatic parameter setting	Refer to
3	Base frequency	60Hz	60Hz	50Hz	*Chapter 4 of the Instruction Manual (Applied)*
4	Multi-speed setting (high speed)	60Hz	60Hz	50Hz	
20	Acceleration/deceleration reference frequency	60Hz	60Hz	50Hz	
37	Speed display	0	0		
55	Frequency monitoring reference	60Hz	60Hz	50Hz	
66	Stall prevention operation reduction starting frequency	60Hz	60Hz	50Hz	
116	Third output frequency detection	60Hz	60Hz	50Hz	
125 (903)	Terminal 2 frequency setting gain frequency	60Hz	60Hz	50Hz	
126 (905)	Terminal 4 frequency setting gain frequency	60Hz	60Hz	50Hz	
263	Subtraction starting frequency	60Hz	60Hz	50Hz	
266	Power failure deceleration time switchover frequency	60Hz	60Hz	50Hz	
386	Frequency for maximum input pulse	60Hz	60Hz	50Hz	
390*	% setting reference frequency	60Hz	60Hz	50Hz	*FR-A7NL manual*
505	Speed setting reference	60Hz	60Hz	50Hz	*Chapter 4 of the Instruction Manual (Applied)*
808	Forward rotation speed limit	60Hz	60Hz	50Hz	
C14 (918)	Terminal 1 gain frequency (speed)	60Hz	60Hz	50Hz	

* This parameter can be set when the option FR-A7NL is mounted.

· Acceleration/deceleration time increment (*Pr.999* = "30(0.1s) or 31(0.01s)")

Parameter	Name	Initial set increment	*Pr.999* = "30"	*Pr.999* = "31" Automatic parameter setting	Refer to
7	Acceleration time	0.1s	0.1s	0.01s	*Chapter 4 of the Instruction Manual (Applied)*
8	Deceleration time	0.1s	0.1s	0.01s	
16	Jog acceleration/deceleration time	0.1s	0.1s	0.01s	
21	Acceleration/deceleration time increments	1	0 *	1 *	
44	Second acceleration/ deceleration time	0.1s	0.1s	0.01s	
45	Second deceleration time	0.1s	0.1s	0.01s	
110	Third acceleration/ deceleration time	0.1s	0.1s	0.01s	
111	Third deceleration time	0.1s	0.1s	0.01s	
264	Power-failure deceleration time 1	0.1s	0.1s	0.01s	
265	Power-failure deceleration time 2	0.1s	0.1s	0.01s	
791	Acceleration time in low-speed range	0.1s	0.1s	0.01s	
792	Deceleration time in low-speed range	0.1s	0.1s	0.01s	

* The set value is changed for *Pr. 21*.

REMARKS

· When a parameter is set as the acceleration/deceleration time (0.1s), the 0.01s increment is dropped.
· When a parameter is set as the acceleration/deceleration time (0.01s), the parameters are limited at the maximum value of the parameter setting range. For example, *Pr.7* = "361.0s" when 0.1s increment is selected, and *Pr.7* = "360.00s" when 0.01s increment is selected.

6 Setting to disable E.OLT during stop-on-contact control

You can set the following parameter so that E.OLT (stall prevention stop) will not be activated during stop-on-contact control.

Parameter Number	Name	Initial Value	Setting Range	Description	
270	**Stop-on contact/ load torque high-speed frequency control selection**	0	0	Normal operation	
			1	Stop-on-contact control	
			2	Load torque high speed frequency control	
			3	Stop-on-contact+load torque high speed frequency control	
			11	Stop-on-contact control	E.OLT invalid under stop-on-contact control
			13	Stop-on-contact+load torque high speed frequency control	

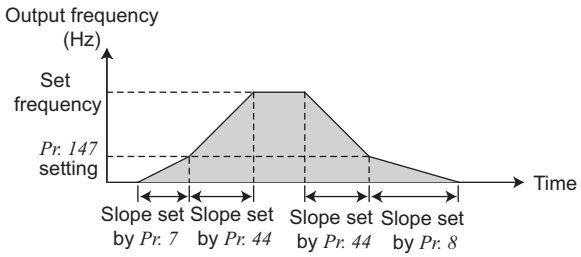
7 Acceleration/deceleration time switching frequency (*Pr. 147*)

When output frequency reaches *Pr. 147 Acceleration/deceleration time switching frequency* or higher, the acceleration/deceleration time automatically switches to *Pr. 44 Second acceleration/deceleration time* and *Pr. 45 Second deceleration time* settings.
The RT signal is not necessary for switching the acceleration/deceleration time.

Parameter Number	Name	Initial Value	Setting Range	Description
147	**Acceleration/ deceleration time switching frequency**	9999	0 to 400Hz	Frequency when automatically switching to the acceleration/deceleration time of *Pr. 44* and *Pr. 45*.
			9999	No function

- When the RT signal (X9 signal) turns ON, the acceleration/deceleration time switches to the second (third) acceleration/deceleration time even when the output frequency has not reached the *Pr. 147* setting. Priority of switching is X9 signal > RT signal > *Pr. 147* setting.
- If the *Pr. 147* setting is lower than *Pr. 10 DC injection brake operation frequency* or *Pr. 13 Starting frequency* setting, the acceleration/deceleration time switches to the *Pr. 44 (Pr. 45)* setting when the output frequency exceeds the *Pr. 10* or *Pr. 13* setting.

Pr. 147 Setting	Acceleration/Deceleration Time	Description
9999 (initial value)	*Pr. 7, Pr. 8*	No automatic switching of the acceleration/deceleration time
0.00Hz	*Pr. 44, Pr. 45*	Second acceleration/deceleration time from a start
0.01Hz ≤ *Pr. 147* ≤ Set frequency	Output frequency < *Pr. 147* : *Pr. 7, Pr. 8* *Pr. 147* ≤ Output frequency : *Pr. 44, Pr. 45*	Acceleration/deceleration time automatic switching
Set frequency < *Pr. 147*	*Pr. 7, Pr. 8*	No automatic switching, since output frequency will not reach the switching frequency



• Switching frequency for each control method

Control Method	Switching frequency
V/F control	Output frequency
Advanced magnetic flux vector control	Output frequency before the slip compensation
Real sensorless vector control	Estimated speed converted as frequency
Vector control, encoder feedback control	Actual motor speed converted as frequency

8 USB automatic recognition (*Pr. 551 PU mode operation command source selection* = "9999")

FR-A701 can automatically recognize the USB connection and switch the command source during PU operation mode.

Parameter Number	Name	Initial Value	Setting Range	Description
551 *	PU mode operation command source selection	9999	1	RS-485 terminals are the command source when PU operation mode.
			2	PU connector is the command source when PU operation mode.
			3	USB connector is the command source when PU operation mode.
			9999	USB automatic recognition Normally, the PU connector is the command source. When USB is connected, the USB connector is the command source.

* This parameter allows its setting to be changed in any operation mode even if "0 (initial value)" is set in *Pr. 77 Parameter write selection*.
When a communication option is installed, parameter setting is always enabled.

9 Modbus-RTU communication stop bit length selection (Pr. 333, Pr. 334)

The stop bit length can be selected for the Modbus-RTU communication.

- When parity checking is not performed (*Pr. 334 RS-485 communication parity check selection* = "0"), the stop bit length can be selected with *Pr. 333 RS-485 communication stop bit length*.

Parameter number	Name	Initial value	Setting range	Description	
333	RS-485 communication stop bit length	1	0	Stop bit length 1 bit	Valid when *Pr. 334* = "0"
			1	Stop bit length 2 bits	
			10	Stop bit length 1 bit	
			11	Stop bit length 2 bits	
334	RS-485 communication parity check selection	2	0	Without parity check Stop bit length according to *Pr. 333*	
			1	With odd parity Stop bit length 1 bit	
			2	With even parity Stop bit length 1 bit	

10 Plug-in option compatibility

(1) FR-A7AZ

The motor temperature detection signal (Y55) and the motor temperature monitor output of the plug-in option FR-A7AZ is supported. For the details of FR-A7AZ, refer to *the Instruction Manual of FR-A7AZ*.

(2) FR-A7AD

The plug-in option FR-A7AD is supported. The 0V voltage calibration request signal (X83) and the during 0V calibration signal (Y83) can be used for 0V calibration of the high speed analog output. For the details of FR-A7AD, refer to *the Instruction Manual of FR-A7AD*.

(3) FR-A7NCE

For the details of FR-A7NCE, refer to *the Instruction Manual of FR-A7NCE*.

The communication option FR-A7NCE is supported. The following monitor items are assigned to the remote registers RWrn+71 and RWrn+72. (Refer to page 40 of the Instruction Manual of FR-A7NCE.)

Address	Description	
	Upper 8 bits	Lower 8 bits
RWrn+71	Output power (with regenerative display)	
RWrn+72	Cumulative regenerative power	

For the details of FR-A7NCE, refer to *the Instruction Manual of FR-A7NCE*

(4) FR-A7NF

The communication option FR-A7NF is supported. When the FR-A7NF is used for the FR-A701 series, the inverter is operated in the PU operation interlock (X12 signal) specification. For the details of FR-A7NF, refer to *the Instruction Manual of FR-A7NF.*

(5) FR-A701 dedicated monitor code / fault code for communication options

The FR-A701 dedicated monitor codes and the fault codes when the communication options are used are as shown below.

• Monitor code

Code Number		Monitor Description	Increments
FR-A7NCE	FR-A7NF		
H41	H10000210	Output power (with regenerative display)	0.1kW
H42	H10000212	Cumulative regenerative power	1kWh

• Fault code (fault data)

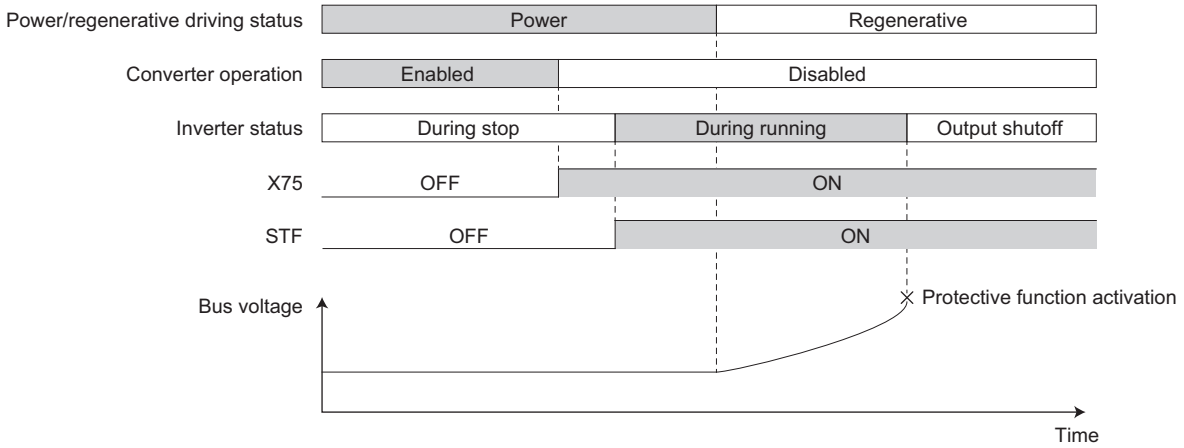
Fault code (data)	Fault indication (description)	Fault name
HF4	E.4	Fault 4 (Converter overcurrent)
HF8	E.8	Fault 8 (Power supply fault)
HFA	E.10	Fault 10 (Converter transistor protection thermal operation (electronic thermal))
HFF	E.15	Fault 15 (Convertor circuit fault)

11 Regenerative operation stop signal (X75 signal)

The converter operation can be stopped by turning ON the X75 signal.

Parameter Number	Name	Initial Value	Initial signal	Setting Range
178	**STF terminal function selection**	60	STF (Forward rotation command)	0 to 9, 12 to 20, 22 to 28, 42 to 44, 60, 62, 64 to 69, 74, **75**, 9999
179	**STR terminal function selection**	61	STR (Reverse rotation command)	0 to 9, 12 to 20, 23 to 28, 42 to 44, 61, 62, 64 to 69, 74, **75**, 9999
180	**RL terminal function selection**	0	RL (Low-speed operation command)	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62, 64 to 69, 74, **75**, 9999
181	**RM terminal function selection**	1	RM (Middle-speed operation command)	
182	**RH terminal function selection**	2	RH (High-speed operation command)	
183	**RT terminal function selection**	3	RT (Second function selection)	
184	**AU terminal function selection**	4	AU (Terminal 4 input selection)	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62 to 69, 74, **75**, 9999
185	**JOG terminal function selection**	5	JOG (Jog operation selection)	0 to 9, 12 to 20, 22 to 28, 42 to 44, 62, 64 to 69, 74, **75**, 9999
186	**CS terminal function selection**	6	CS (Electronic bypass function)	
187	**MRS terminal function selection**	24	MRS (Output stop)	
188	**STOP terminal function selection**	25	STOP (Start self-holding selection)	
189	**RES terminal function selection**	62	RES (Inverter reset)	

- The converter operation stops when the X75 signal is turned ON during an inverter stop.
- When the regenerative status is entered during a converter stop, the protective function (E.OV☐) is activated due to overvoltage, and the inverter trips.
- To apply the X75 signal status to the converter operation, it is necessary to stop the inverter.



REMARKS

- If the X75 signal is turned ON while the inverter is running and remains ON, the X75 signal will be valid after the inverter stops.
- If the inverter is reset by turning ON the RES signal while the converter operation is stopped by the X75 signal, the converter stopped status is retained even while the reset is being processed.

12 Support for the PU operation mode of the brake sequence function

The brake sequence function is enabled when either the PU operation mode or the External/PU combined operation mode 2 is selected.

13 Parameter for manufacturer setting

- *Pr. 414 to Pr. 417, Pr. 498, Pr. 506 to Pr. 515* are parameters for manufacturer setting. Do not set.
- The setting value "50" of *Pr. 178 to Pr. 189 (input terminal function selection)* is for manufacturer setting. Do not set.

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IB(NA)-0600331ENG-E(1012)MEE Printed in Japan

Specifications subject to change without notice.